

Barbee Lakes Aquatic Plant Management Plan Revision 2007-2011
Kosciusko County, Indiana

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BARBEE LAKES AQUATIC PLANT MANAGMEENT PLAN REVISION 2007-2011 KOSCIUSKO COUNTY, INDIANA

EXECUTIVE SUMMARY

This document is intended to revise the 2004 Draft Aquatic Plant Management Plan and the 2005 Aquatic Plant Management Plan update. Additionally, this document builds on the historic aquatic plant management planning efforts in the Barbee Lakes, Kosciusko County, Indiana.

The following update specifically addresses the results of the aquatic plant chemical treatments conducted during the 2007 season and compares the results with variations in the plant communities in all seven lakes over a period of the past four growing seasons. The Aquatic Plant Management Plan Draft completed by Weed Patrol in 2004 should be consulted for complete information regarding aquatic plant management at the Barbee Lakes. Likewise the 2005 update should be reviewed for specifics of the 2005 sampling results and treatment information.

In 2007, the only method of control was chemical in nature and was intended to target Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*). Both species are exotic to Indiana lakes. On May 10, 2007, nearly 150 acres of curly-leaf pondweed were treated by Weed Patrol Inc. (Elkhart, Indiana) within the lakes. On June 12 and 13, 2007, Weed Patrol Inc. treated approximately 70 acres of Eurasian watermilfoil throughout the lakes, while the treatment of filamentous algae occurred on multiple days during the summer. Three types of chemical treatments occurred which targeted these three different species. Due to differences in acreage treated and dosage utilized, treatment methodologies differed for the three target species. A low rate of Aquathol K herbicide was used to control curly-leaf pondweed while not harming native pondweeds or other aquatic species. Areas were treated selectively for Eurasian watermilfoil using 2, 4-D. Copper sulfate was used at a rate of 2.6 lb/acre-foot to treat filamentous algae throughout the seven lakes.

Two Tier II surveys were conducted during the spring (May 15 to June 15) and summer (July 15 to August 30). The former is a pre-treatment survey which occurred to determine the nature of the plant community, and the latter is a mid-summer survey to determine how the aquatic plant community responded following treatment. In the Barbee Lakes, the spring, pre-treatment survey was completed following the curly-leaf pondweed treatment but prior to the Eurasian watermilfoil treatment. Comparison of 2007 spring and summer Tier II survey data shows that the relative density and abundance of curly-leaf pondweed and Eurasian watermilfoil decreased from the spring to the summer survey.

JFNew's review of Tier II surveys from 2005 to 2007 indicates that herbicidal treatment of Eurasian watermilfoil and curly-leaf pondweed are providing mixed results in control of both these two exotic species in the Barbee Lakes. Comparison of spring Tier II survey data from 2005 and 2007, data indicate that Eurasian watermilfoil mean and relative densities increased. Eurasian watermilfoil frequency and dominance also increased from 2005 to 2007. This is not the case for curly-leaf pondweed populations; in comparing spring Tier II data of curly-leaf pondweed in 2005 to 2007, this species decreased in frequency in Big Barbee, Irish, Little Barbee, and Sawmill lakes. Curly-leaf pondweed was not present in Banning and Sechrist Lake in 2005, but was present at 10% and 32% of the sites in 2007, respectively. Kuhn Lake's curly-leaf pondweed site frequency increased from

22.5% to 42% of the sites. Mean and relative densities followed a similar pattern with decreases and increases in similar lakes from 2005 to 2007.

The effects of the treatment on the native aquatic plant community are unclear. Comparing the 2007 spring and summer Tier II survey metrics indicates that the quality of the native aquatic plant community in Barbee Lakes increased following treatment. The native rake diversity (SDI) increased following treatment. However, the number of native plant species found in the Barbee Lakes decreased in some lakes and increased in others from the spring to the summer surveys.

Additional items including a public meeting and a meeting between the contractor, LARE program staff, the district fisheries biologist, and a representative from the Barbee Lakes Association (BLA), also occurred in concert with this aquatic plant management plan update. The details of these are not repeated here, but were utilized to generate recommendations as follows:

1. Early season assessment of curly-leaf pondweed populations to determine if treatment is necessary. Treatment should occur when water temperatures approach 50°. At this time, treatment of 150 acres of curly-leaf pondweed is estimated to occur in 2008.
2. Assessment of channels along Big Barbee Lake's southern shoreline, Kuhn Lake's northern and eastern shorelines, Little Barbee Lake's eastern and western shorelines, Irish Lake's eastern and western shorelines, and Sawmill Lake's northern shoreline, is also necessary. These areas are thought to act as nurseries for Eurasian watermilfoil. Treatment of these areas should result in less reintroduction of Eurasian watermilfoil from the channels into the main body of the lakes.
3. Treatment of approximately 75 acres of Eurasian watermilfoil throughout the Barbee Lakes. Areas are identified in the following sections, but should be confirmed prior to treatment occurring in 2008.
4. Implement control of native species whose growth has reached nuisance levels. Specifically, control of eel grass within Irish Lake and coontail within Little Barbee, Big Barbee, and Sawmill lakes should be implemented. At this time, it is estimated that control of eel grass will cover up to 15 acres while control of coontail will cover up to 30 acres in 2008.
5. Continue pre- and post-treatment assessments to determine how the aquatic plant community within the Barbee Lakes changes over time.

In 2008, treatment, aquatic plant community assessment, and plan updates are anticipated to cost \$126,750. Treatment costs should be reduced over the following years and at a minimum should not exceed \$126,750.

ACKNOWLEDGEMENTS

The Indiana Department of Natural Resources Division of Fish & Wildlife as part of the Lake and River Enhancement Program (LARE) provided funding for the development of this plan. The plan has been developed in cooperation with the Barbee Lakes Association. Fieldwork, data analysis and map generation was performed by JFNew with the assistance of the Barbee Lakes Association. Special thanks to Bill Thompson for his assistance and driving abilities. Contributors include: Sara Peel and Betsy Ewoldt.

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BARBEE LAKES AQUATIC PLANT MANAGEMENT PLAN REVISION 2007-2011 KOSCIUSKO COUNTY, INDIANA

1.0 Introduction

This report serves as a revision of the 2004 Barbee Lakes (Banning, Big Barbee, Irish, Kuhn, Little Barbee, Sawmill, and Sechrist lakes) Aquatic Management Plan. This revision will serve as a tool to track changes in the vegetative community, to adjust the action plan as needed, and to maintain eligibility for additional LARE funds. Items covered include a review of historic, 2006, and 2007 vegetation control efforts; spring and summer tier II results from the 2007 season; a comparison of Tier II results from 2005 to 2007 performed by Weed Patrol and JFNew; a recap from the public meeting; and a discussion of potential management implications of the results. The plan update was funded by the Indiana Department of Natural Resources (IDNR) Lake and River Enhancement Program (LARE) and the Barbee Lakes Association (BLA). This is the fourth year that the Barbee Lakes have been involved in aquatic plant management planning through the LARE program.

The Barbee Lakes chain is a group of seven inter-connected natural lakes that lies in the northeast corner of Kosciusko County, Indiana (Figure 1). Specifically, the lakes are located in Sections 20, 21, 26, 27, 28, 29, 33, and 34, Township 33 North, Range 7 East. The Barbee Lakes watershed stretches out to the east and south of the lakes encompassing approximately 33,191 acres (52 square miles). Water from the lakes discharges to Lake Tippecanoe. From Lake Tippecanoe, water drains through the Tippecanoe River to the Wabash River, eventually reaching the Ohio River in southwestern Indiana.

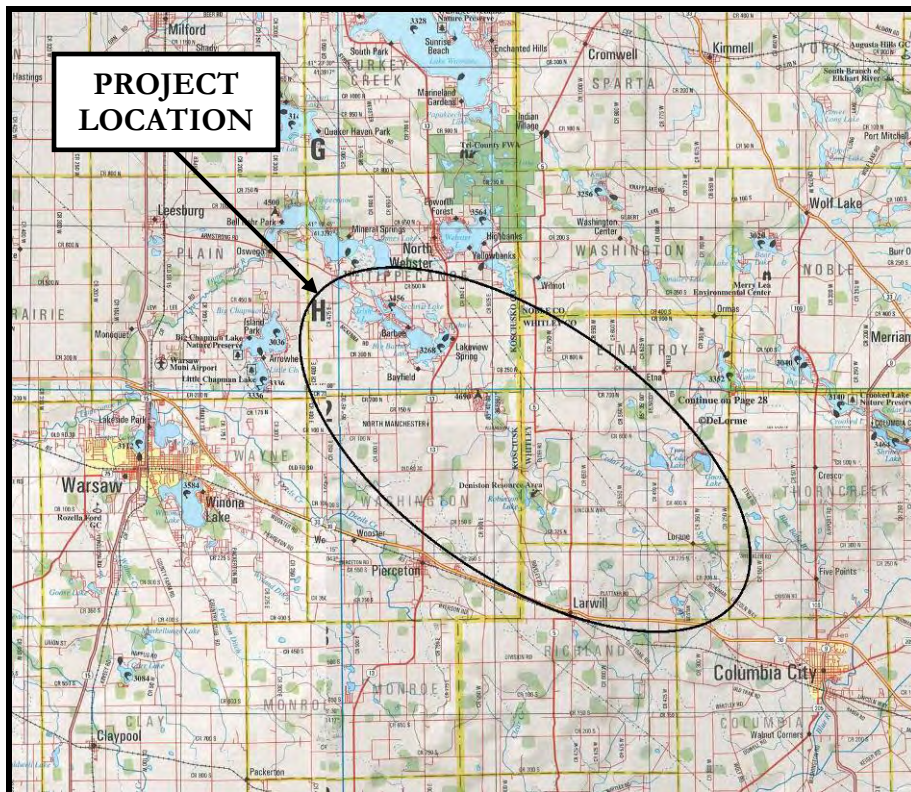


Figure 1. General location of the Barbee Lakes watershed. Source: DeLorme, 1998.

During the 2007 growing season the following actions were taken.

- May 10, 2007; 138 acres of curly-leaf pondweed treated on all lakes.
- June 6-7, 2007; Tier II aquatic plant survey completed on all seven lakes.
- June 12-13, 2007; 52 acres of Eurasian watermilfoil treated on all lakes.
- August 8 and 24, 2007; Tier II aquatic plant surveys completed on all seven lakes.
- October 6, 2007; Public meeting to discuss initial aquatic plant survey results and treatment.
- October 24, 2007; Meeting between the BLA, JFNew, Weed Patrol Inc., and IDNR to discuss 2008 treatment options

2.0 Watershed and Lake Characteristics

2.1 Watershed Characteristics

The Barbee Lake chain is composed of seven interconnected, natural lakes totaling 851 acres in surface area. The chain includes Kuhn, Big and Little Barbee, Irish, Banning, Sechrist, and Sawmill lakes. Two smaller lakes, Shoe and Heron lakes, are also hydrologically connected to the Barbee Chain. Water from Heron Lake flows into Kuhn Lake, which in turn flows into Big Barbee Lake. Shoe Lake discharges to Banning Lake, which discharges to Irish Lake. Sechrist Lake discharges to Sawmill Lake. The remaining four lakes of the chain, Big and Little Barbee, Irish and Sawmill Lakes, lie along Grassy Creek, a major tributary to the Tippecanoe River.

While Shoe and Heron lakes are hydrologically connected to the Barbee Lakes Chain, they were not included as part of this study. No public access sites are located at these lakes. Nor can they be accessed by boat from Banning or Kuhn lakes. In addition, the lakes influence on the Barbee chain's water quality is likely small in comparison to the influence exerted by the rest of the watershed included in the study. Both lakes have very small watersheds, limited primarily to their immediate shorelines. Wetland vegetation surrounds Heron Lake protecting its water quality. Wetland vegetation between Heron Lake and Kuhn Lake filters water discharging to Kuhn Lake. While single family residences border Shoe Lake's shoreline, wetland vegetation filters water at the lake's outlet before it reaches Banning Lake. This vegetation likely removes much of the suspended solids (and any nutrients attached to the solids), but may not affect dissolved nutrient transport to Banning Lake. Nonetheless, Shoe and Heron lakes, like other lakes in the watershed, may serve as a source of exotic aquatic plant species for the Barbee Lakes.

Grassy Creek is the largest source of discharge to the Barbee Lakes Chain draining approximately 25,000 acres or 75% of the total watershed. Several other lakes exist upstream of the Barbee Lakes Chain on Grassy Creek and its tributaries. Ridinger Lake lies immediately upstream of the chain. Pierceton Lake, Robinson Lake, Troy Cedar Lake and other smaller lakes are located further upstream. All of these lakes can act as nurseries for curly-leaf pondweed and Eurasian watermilfoil, which can then flow downstream into the Barbee Lakes. Until exotic aquatic plant species are controlled within each of these lakes, it is unlikely that either species will be controlled in the Barbee Lakes. Additionally, Putney Ditch, draining approximately 2,750 acres, is the second largest inlet to the Barbee chain.

2.1.2 Land Use

Figure 2 and Table 1 present current land use information for the Barbee Lakes watershed. Like many Indiana watersheds, agricultural land use dominates the Barbee Lakes watershed, accounting for approximately 78.5% of the watershed. Row crop agriculture comprises the greatest percentage of agricultural land use at 64.4%, while pastures or hay vegetate another 14.1%. Land uses other than agriculture account for the remaining 21.5% of the watershed. Natural landscapes, including forests and wetland, cover approximately 15.8% of the watershed. Most of the remaining 5.7% of the watershed is occupied by low intensity residential land, with less than 1% of high intensity residential and high intensity commercial land.

Table 1. Detailed land use in the Barbee Lakes watershed.

Land Use	Area (acres)	Area (hectares)	% of Watershed
Row Crops	21,364.3	8,645.8	64.4%
Pasture/Hay	4,669.6	1,889.7	14.1%
Deciduous Forest	3,681.9	1,490.0	11.1%
Open Water	1,318.6	533.6	4.0%
Woody Wetlands	1,219.6	493.6	3.7%
Low Intensity Residential	516.8	209.1	1.6%
Emergent Herbaceous Wetlands	317.3	128.4	1.0%
High Intensity Commercial	55.2	22.3	0.2%
High Intensity Residential	36	14.6	0.1%
Evergreen Forest	11	4.5	<0.1%
Mixed Forest	1.3	0.5	<0.1%
Entire Watershed	33,191	13,431.9	100.0%

Source: USGS EROS, 1998.

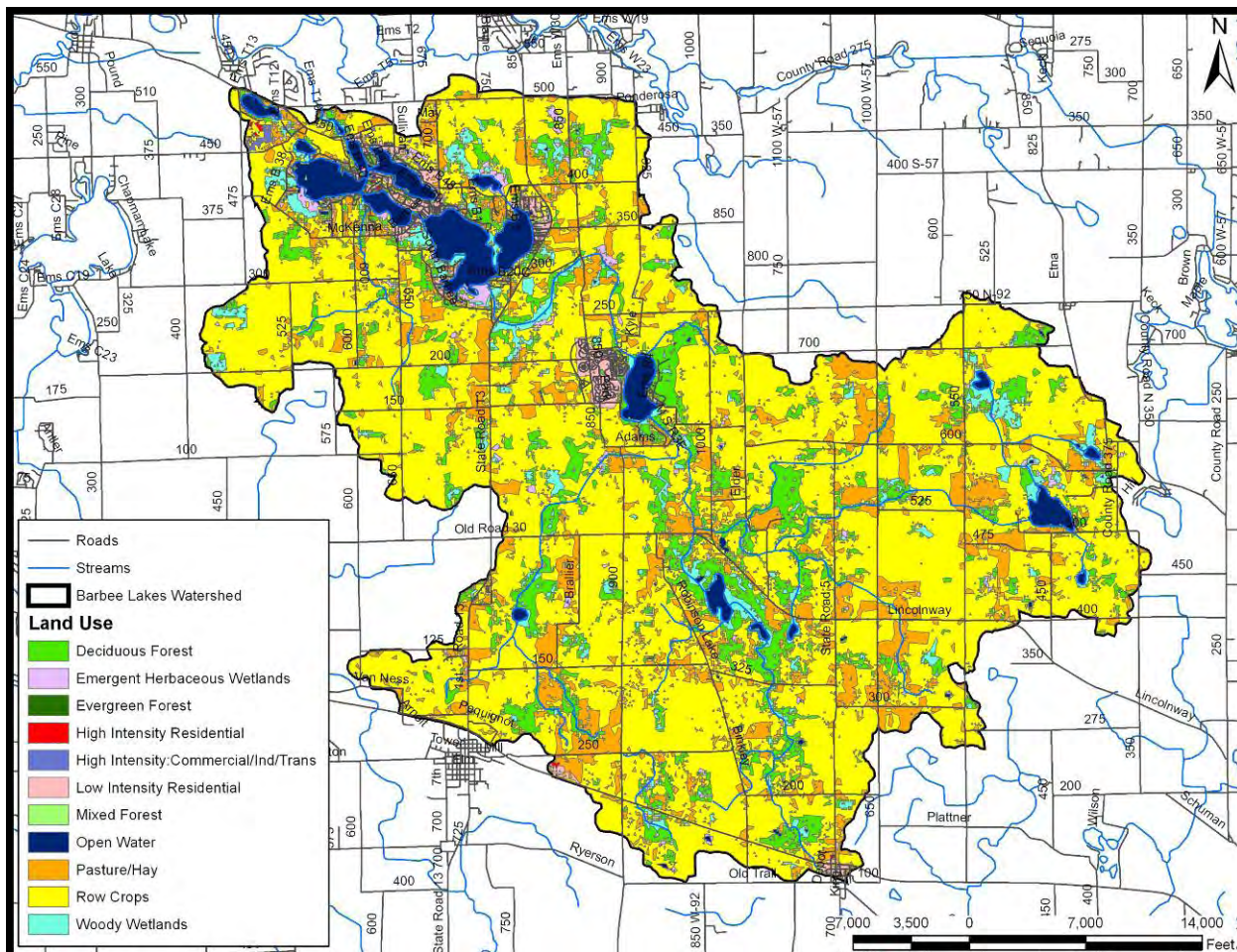


Figure 2. Land use in the Barbee Lakes watershed.

Source: USGS EROS, 1998.

2.2 Lake Characteristics

2.2.1 Morphology

Figures 3 through 5 present Barbee Lakes' morphology. Banning Lake is the smallest of all seven lakes with a surface area of 12 (4.9 ha) acres and its deepest basin measuring only 16 feet (4.9 m) in the center of the lake. Irish Lake is the second largest lake in the chain with a surface area of 182 acres (73.7 ha). The maximum depth in Irish Lake is 35 feet (10.7 m) and is located on the north side of the lake (Figure 3). Sawmill Lake has a surface area of 74 acres (30.0 ha). The deepest portion of the lake measures 26 feet (7.9 m) and is located on the north side of the lake. Sechrist Lake has the deepest point in all seven lakes, 59 feet (18.0 m), and a surface area of 105 acres (42.5 ha). Little Barbee Lake's deepest point is on the west side of the lake, measuring at 26 feet (7.9 m), and the lake's surface area is 74 acres (30.0 ha; Figure 4). Big Barbee is the largest in the chain of lakes with a surface area of 304 acres (123.0 ha) and a maximum depth of 45 feet (13.7 m). Kuhn Lakes lies the furthest to the east of all the lakes and has a surface area of 137 acres (55.4 ha) with a maximum depth of 28 feet (8.5 m). See Table 2 for a summary of the Barbee Lakes morphology.



Figure 3. Banning and Irish Lakes bathymetric map. Source: IDNR, 1965.

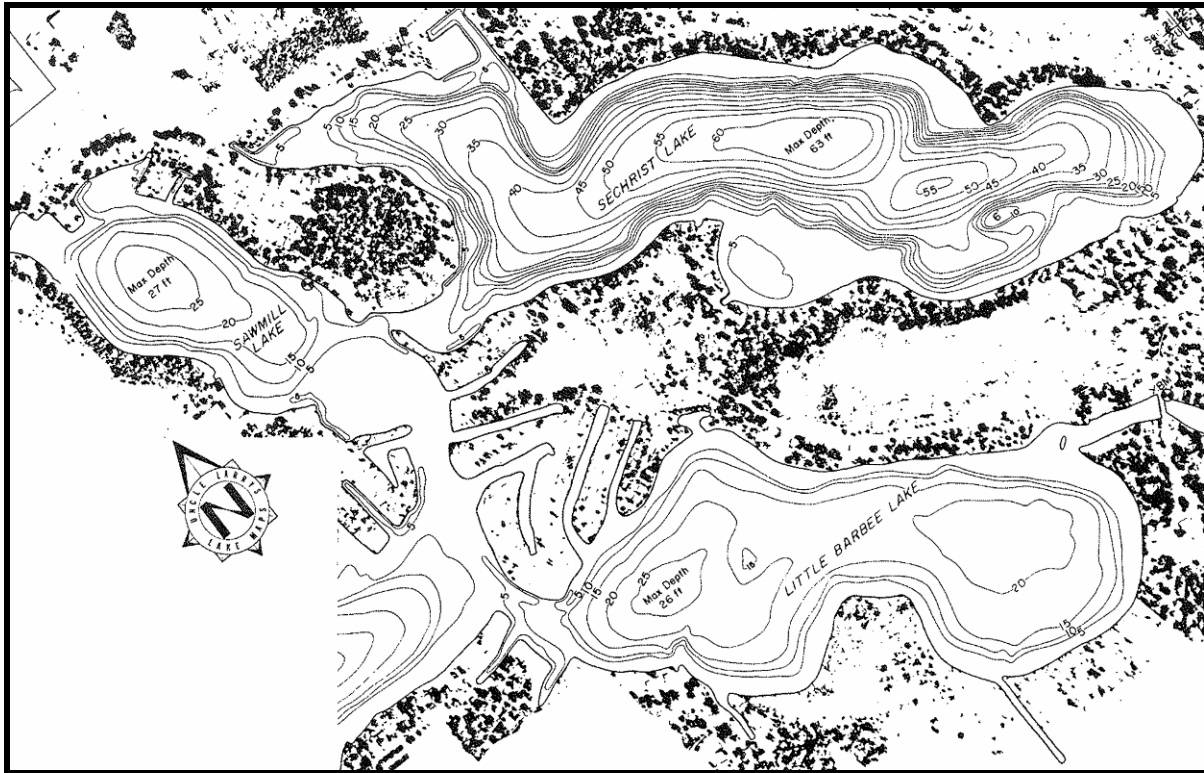


Figure 4. Little Barbee, Sawmill, and Sechrist Lakes bathymetric map. Source: IDNR, 1965.

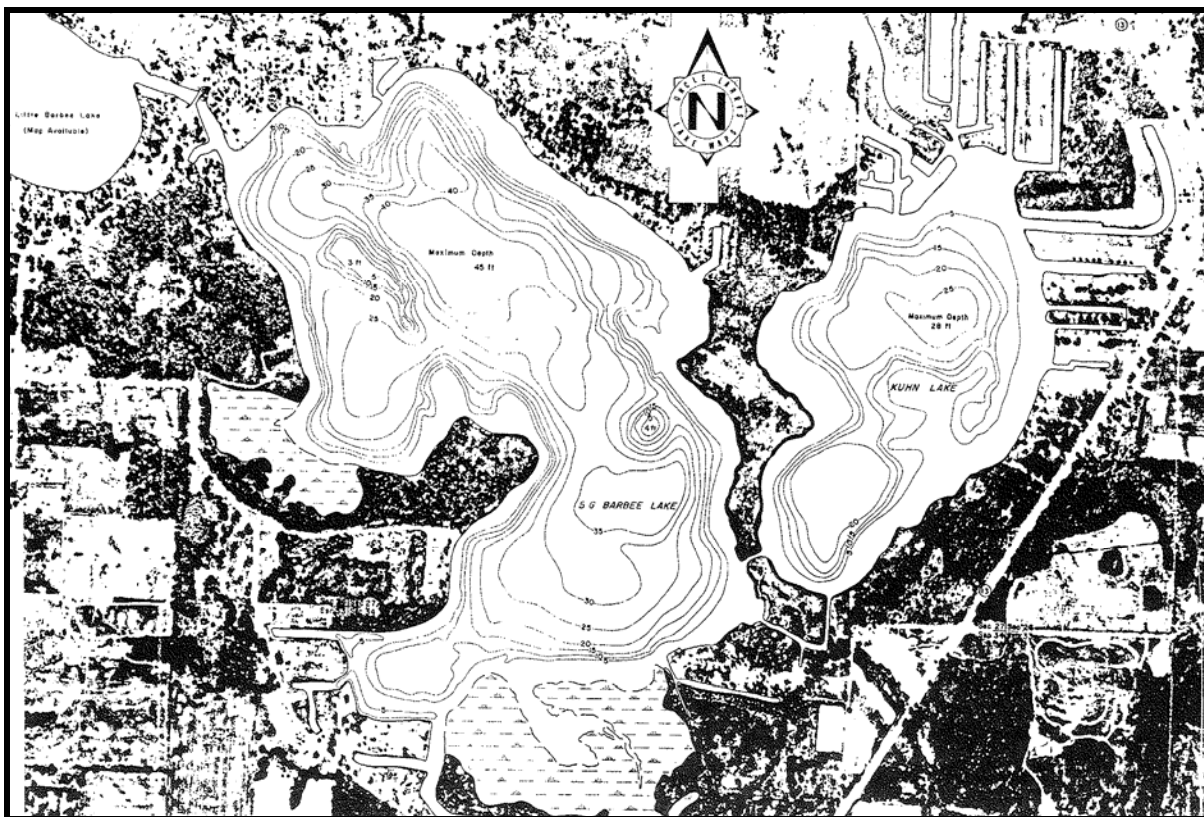


Figure 5. Big Barbee and Kuhn Lakes bathymetric map. Source: IDNR, 1965.

Table 2 summarizes the surface area, volume and other geographic information for the Barbee Lakes and their watershed. The Barbee Lakes watershed encompasses approximately 33,191 acres (13,432 ha) or 52 square miles (133 km²). This results in a watershed area to lake area ratio of approximately 37.4:1. Watershed size can affect the chemical and biological characteristics of a lake. For example, lakes with large watersheds have the potential to receive more pollutants (sediments, nutrients, pesticides, etc.) from runoff than lakes with smaller watersheds. Consequently, for lakes with large watershed to lake ratios, watershed activities can potentially exert a greater influence on the health of the lake than lakes possessing small watershed to lake ratios. Conversely, for lakes with small watershed to lake ratios, shoreline activities may have a greater influence on the lake's health than is the case for lake's with large watershed to lake ratios.

Barbee Lakes possess a fairly normal watershed area to lake area ratio for glacial lakes (Vant, 1987). This ratio is also relatively normal when compared to other lakes in northern Indiana. Lake Tippecanoe, Ridinger Lake, and Smalley Lake, glacial lakes in the Upper Tippecanoe River watershed in Kosciusko, Noble, and Whitley Counties, possess watershed area to lake area ratios of 93:1, 165:1, and 248:1, respectively. All of these lakes have extensive watersheds compared to Barbee Lakes. Barbee Lakes' watershed area to lake area ratio is typical for glacial lakes. Many glacial lakes have watershed area to lake area ratios of less than 50:1 and watershed area to lake area ratios on the order of 10:1 are fairly common (Vant, 1987).

The average depth of the Barbee Lakes is 16 feet (4.9 m). The deepest point, 59 feet (18 m), is located in Sechrist Lake. Big Barbee lake possesses the greatest volume (4,749 acre-ft or 5.9×10^6 m³), largely due to its large surface area. Shoreline Development (D_L) is a measure of how circular a lake is. It compares the shoreline length to the circumference of a circle of the same area. For example, a perfect circle has a D_L of 1.0 since its length and circumference are equal. As lake shape deviates from a perfect circle, shoreline development increases in value and there is proportionately more shoreline per lake area. Embayments along the shoreline add to shoreline length. All this has important implications for shoreline impacts such as the amount of shoreline available for home sites, the amount of shallow water, and the amount of shoreline that could erode. Of the Barbee Lakes, Kuhn Lake has the highest shoreline development and Banning has the smallest shoreline development.

Table 2. Morphological characteristics of the Barbee Lakes.

Lake	Surface Area (acres)	Maximum Depth (ft)	Mean Depth (ft)	Volume (ac-ft)	Watershed size (ac)	Shoreline Development
Banning	12	17	7.8	93	312	1.50
Big Barbee	304	45	15.6	4,749	28,737	2.72
Irish	182	35	10.7	1,952	32,483	2.98
Kuhn	137	28	7.9	1,076	2,374	3.84
Little Barbee	74	26	11.0	816	31,607	2.34
Sawmill	74	26	8.6	308	33,099	1.94
Sechrist	105	59	18.9	1,989	270	1.92

2.2.2 Shoreline Development

Early historical accounts of the area suggest settlers of European descent utilized the Barbee Lakes Chain area as early as 1840. These records show the construction of a dam on Grassy Creek downstream of Sawmill Lake in an effort to harness power for a gristmill (Blatchley, 1900). Blatchley (1900) also notes that the Barbee lakes were well known for their fishing and consequently

club houses/resort areas were built along the lakes' shorelines for anglers in the 1800's. Despite this, a 1900 map of the area shows much of the shoreline as undeveloped, native wetland habitat.

Modern development around the Barbee Lakes Chain began in the 1920's with most homes built above the high water mark. In the 1950's as lakefront property became scarce, development expanded into wetland areas. Most of the wetland areas surrounding these lakes were eliminated by the early 1970's. Channels were constructed by dredging lanes through the wetlands adjacent to the lakes and placing the dredged spoil on the remainder of the wetland to create higher land for residential development. By the time the IDNR started comprehensive fisheries studies on the lakes (1972), nearly all the lakes' shorelines were at least partially developed. Only Banning Lake had not been developed by the date of the survey, but dredging in preparation for development had begun along the shoreline. Taylor (1972) reported that the extensive channeling and development have destroyed much of the natural shoreline. Hippensteel (1989) documented 894 homes bordering six of the Barbee Lakes in 1980. (This count excludes Banning Lake.) By 1997, virtually all of the shoreline along Sechrist, Sawmill, Little Barbee and Big Barbee lakes was developed (Pearson, 1997).

Not much has changed since the 1997 fisheries study. Today, all of the shoreline along Sechrist, Sawmill, and Little Barbee lakes is developed for residential use. Large portions of Big Barbee, Kuhn, Banning and Irish lakes' shorelines are also developed. Heavily developed channels exist along the Kuhn, Big and Little Barbee, and Irish lakes' shorelines. Channels are also present between many of the lakes. Large, remnant wetlands exist between Kuhn and Big Barbee Lakes, at the mouth of Grassy Creek on the southern shoreline of Big Barbee Lake, and along the southern shoreline of Irish Lake. Smaller wetland pockets exist along Kuhn, Irish, Big Barbee and Banning lakes.

During the watershed diagnostic study, estimates for the number of homes along the Barbee Lakes shoreline ranged from 1500 to 2300. Barry Hecker, Lake Barbee Conservancy District, (personal communication) estimated the number of homes around the Barbee Lakes at 1550. Of these homes, one third are permanent residences; one third are utilized seasonally and on weekends; and one third are occupied during all but the winter months of the year (December through March). At the same time, the Kosciusko County Assessor's Office (personal communication) placed the number of homes around the Barbee Lakes chain closer to 2300.

As is typical of other northern Indiana lakes, the number of permanent residences around the Barbee Lakes chain is increasing as lake residents retire to live at their lake homes fulltime. Many lake residents are remodeling or improving their existing lake cottages to convert them to permanent residences. Destroying an existing cottage and replacing it on the same property with a more modern residence is common as well. Additional cottages are also being placed on lots that were previously occupied by only one cottage, further increasing the density of development along the lakes' shorelines.

With residential development of the lakes, landscaped lawns and seawalls replace natural wetland areas and shoreline vegetation. Currently, seawalls line much of the developed shoreline along the Barbee lakes. Seawalls border almost all of Little Barbee, Sechrist, and Sawmill lakes and along the developed areas of Big Barbee, Irish and Kuhn lakes. Concrete seawalls line all of the channel areas on the lakes. Many of the seawalls are made of concrete; however, riprap and rail tie seawalls were also noted along the lakes' shorelines. Groomed lawns are maintained behind the seawalls. Private beaches were noted along several of the lakes as well.

While seawalls provide some temporary erosion control along shorelines, they cannot provide all the functions of a healthy shoreline plant community. Native shoreline communities filter runoff water to the lake, protect the shore from wave action limiting erosion, release oxygen to the water column for use by aquatic biota, and provide food, cover and spawning/nesting habitat for a variety of fish, waterfowl, insects, mammals and amphibians. Removal of the native plant community eliminates many of these functions.

2.2.3 Historic Lake and Watershed Assessment

A variety of organizations including Tri-State University, International Science and Technology, Inc., Donan Engineering Company, Inc., and JFNew completed studies to aid in the ecological restoration of the Barbee Lakes. The following list summarizes those studies, but does not include historic fisheries assessments as those findings are summarized under the Fisheries Section.

- In 1989, the Tri-State University Department of Biology conducted a study entitled “Preliminary Investigation of the Lakes of Kosciusko County”. The study examined 28 lakes within the St. Joseph River and Tippecanoe River Basins. The study authors analyzed various land use activities and their impacts on the water quality of the lakes.
- In 1991, International Science and Technology, Inc. conducted the “Feasibility Study of Little Barbee Lake”. The study recommended various watershed projects for improving water quality in Little Barbee Lake including streambank stabilization and sediment basin construction. JFNew implemented the streambank stabilization following recommendations from this report.
- In 1998, Donan Engineering Company, Inc. completed a “Design Report for the Streambank Stabilization of Putney Ditch”. The report recommended the use of live staking, fiber rolls, and live cribwalls to stabilize the streambanks south of McKenna Road.
- In 2000, JFNew conducted the Barbee Lakes Diagnostic Study. The study assessed the ecological health of the Barbee Chain of Lakes and their watershed and documented sediment and nutrient sources to the lakes. The study also included recommendations for improving water quality and aesthetics of the lakes and their tributaries. The 2000 Barbee Lakes Diagnostic Study included the following recommendations that are relevant to Putney Ditch: 1) install filter strips along two reaches of Putney Ditch east of County Road 650 East and north of County Road 200 North, 2) install grassed waterways at the southwest corner of County Road 200 North and County Road 650 East, 3) initiate a feasibility study to examine three potential wetland restoration projects along Putney Ditch, 4) increase levels of conservation tillage practices, and 5) complete a design-feasibility study for dredging select shallow water areas in Little Barbee Lake at the mouth of Putney Ditch.
- In 2002, the Tippecanoe Environmental Lake and Watershed Foundation drafted the “Upper Tippecanoe River Watershed Management Plan.” The plan assessed the eight subwatersheds that comprise the Upper Tippecanoe River watershed. The plan recognized Putney Ditch as a specific area of concern in the Upper Tippecanoe River watershed. Since that time, the plan has undergone revision and has been approved by IDEM. The TELWF is in the process of implementing this plan with assistance from the Barbee Lakes Association.

- In 2002, JFNew and the Barbee Lakes Association completed the Putney Ditch Feasibility Study. This study identified four specific projects within the Putney Ditch watershed and work with landowners and regulatory agency staff to conceptually design potential water quality improvement projects.
- In 2004, the Barbee Lakes Association completed a streambed and bank stabilization project along a reach of Putney Ditch upstream of Little Barbee Lake. JFNew designed and implemented the stabilization using funds from the LARE program.
- In 2006, the Barbee Lakes Association and JFNew completed a sediment removal plan for the Barbee Lakes. The plan identified numerous locations for dredging and identified locations targeted to sediment removal and disposal. This plan was implemented in its first phase in 2006-2007 by the Barbee Lakes Association.

3.0 Lake Uses

A public meeting was held October 6, 2007 to discuss aquatic plant survey results and to conduct a user survey regarding the use of the Barbee Lakes and their aquatic plant management program. (Appendix A contains detailed results from the user survey.) Twenty-three lake residents and/or watershed stakeholders attended the public meeting. Sixteen lake users responded to the survey this year. The responses from meeting attendees indicate that all of them use the lake for boating (100%), while a high percentage use the lake for fishing (88%) and swimming (88%). Another 13% of respondents indicated that Barbee Lakes are used for irrigation. The Barbee Lakes are primarily recreational lakes; therefore, these responses are in line with expectations.

Respondents were also questioned about their perceived problems with the lakes. Figure 6 details the responses of users in regards to perceived problems in the Barbee Lakes. The main concern of Barbee Lakes' users is that too many aquatic plants are present in the lake (75%). Dredging needs were also identified by 75% of respondents, while 63% identified too many boats or jet skis (or other personal watercraft) within Barbee Lakes as a problem. Concerns regarding those dealing with perceived overuse of the lake by non-residents, too many boats on the lake, and problems regarding the fish populations are an issue for 19% of Barbee Lakes' users. Complaints about non-resident use include noise pollution, speeding on and off the lake. Only 6.3% of lake users think that funneling or too much fishing is a problem.

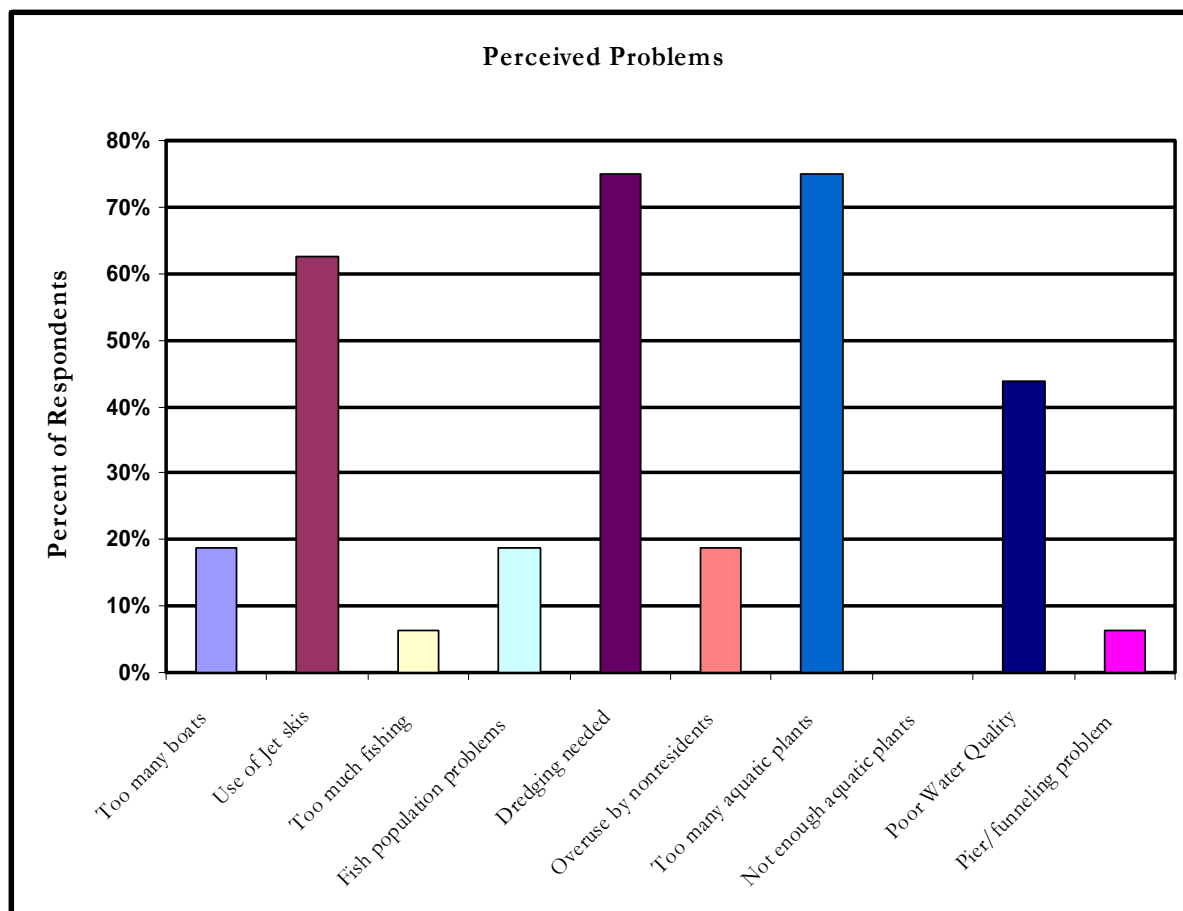


Figure 6. Perceived problems from Barbee Lakes' users.

Many lake users commented on the need for additional weed control in the lake and indicated that they may have too many invasive aquatic plant species and not enough native plant species. The need to treat Eurasian watermilfoil will continue to be a priority for these lakes.

General lake use areas and high quality, natural shorelines are identified in Figure 7. Specifically, the shallow sandbars in Sechrist and Kuhn Lakes are shown. These areas are popular congregating areas, specifically in Kuhn Lake. There is a large ski area in Big Barbee Lake, shown in green. Wave action from skiing and fast speed boating impacts natural shorelines on the east, west, and south sides of Big Barbee Lake. Various slow speed areas are located throughout the Barbee Lakes chain. Sawmill and Banning Lakes have slow speed zones for the entire lake. The channels in between each lake are also slow speed zones and signs are posted along the channels.

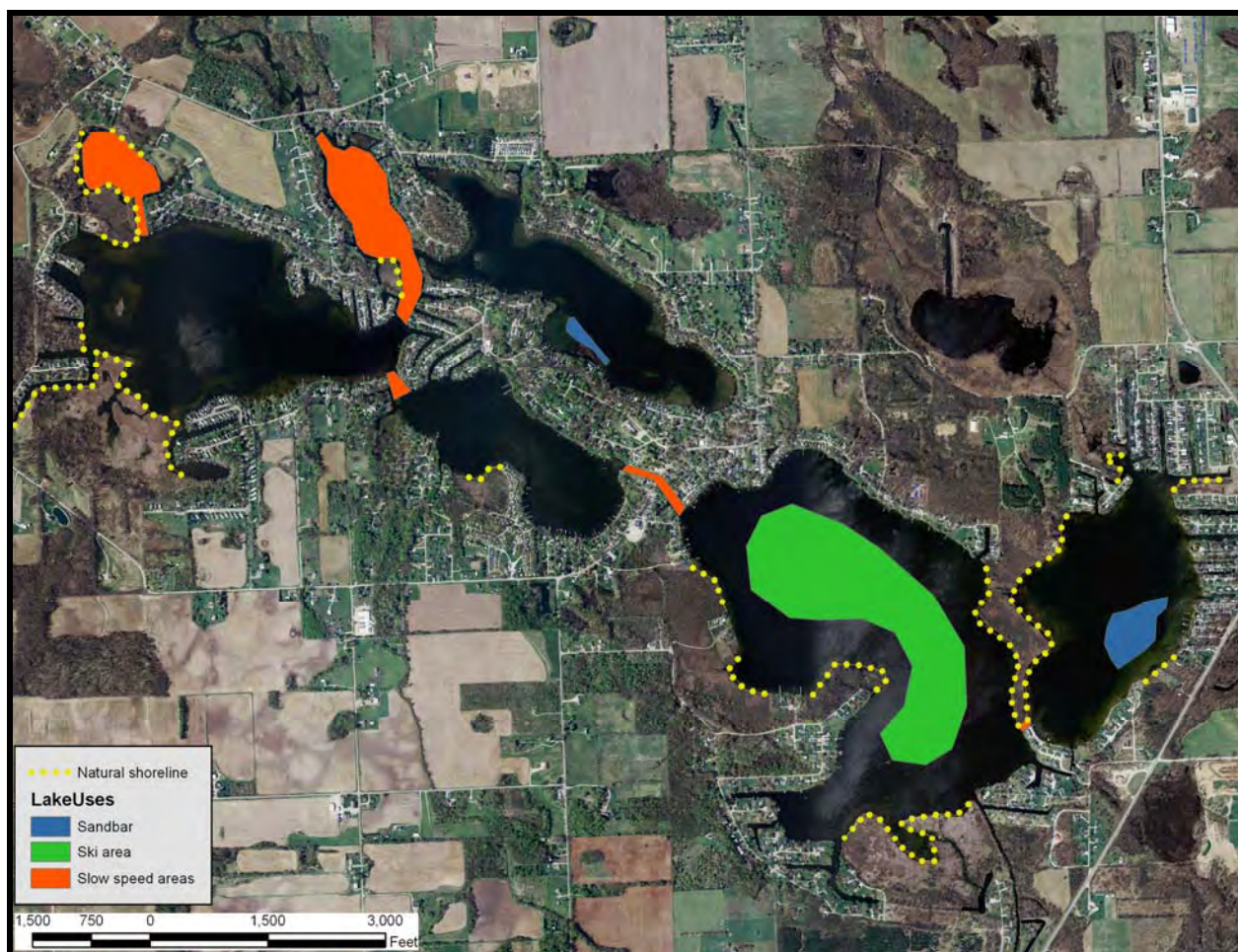


Figure 7. Lake uses within the Barbee Lakes.

4.0 Fisheries

Several studies have been conducted to document the condition of the Barbee Lakes fisheries. The earliest study on record is Tucker's 1922 hydrographic study. In 1942, Ricker examined the growth rates of bluegill in the lakes. The IDNR began tracking the condition of the Barbee Lakes fisheries in 1972. The 1972 IDNR survey was followed by surveys in 1980, 1988, and 1997. Additional studies focusing on the Barbee Lakes' Property Owners Association stocking efforts were conducted in 1983, 1987, and 1990. A list of species observed in the Barbee Lakes is present in Appendix 4 of the Barbee Lakes Diagnostic Study (JFNew, 2000). No surveys have been recorded since 1997.

Table 3 summarizes the relative abundance of dominant fish species found in the Barbee Lakes from 1972 to 1997. The Barbee Lakes Chain fishery is typical of many lakes in northeastern Indiana. Bluegill dominate the fishery with yellow perch, largemouth bass, redear, and lake chubsuckers accounting for much of the remaining fishery. The stocking program on the lakes has added channel catfish and trout to the fish community. Despite being the dominant species, fewer bluegill have been observed in the Barbee Lakes compared to other lakes in the area. The catch per unit effort has increased through 1972 to 1997. The yellow perch population is more comparable to other area lakes; however, the yellow perch are generally small in size. Although largemouth bass often experience fluctuations in their populations, the largemouth bass population in the Barbee Lake appears to be benefiting from the 12-inch catch size limit. In 1998, the size limit increased to 14 inches, which may provide additional benefits to the largemouth bass population. Lastly, the increase in gizzard shad observed in 1997 is of some concern. Non-game fish tie up much of the lakes' production. Increases in the number of planktivores are often related to an increase in nutrient inputs to the lake. Future studies should continue to track gizzard shad population sizes to reveal the presence of any trend toward population increases.

Table 3. Relative abundance of dominant fish species found in the Barbee Lakes from 1972 to 1997.

Fish species	1970	1980	1988	1997
Bluegill	29.0%	30.5%	55.7%	35.7%
Largemouth bass	12.5%	3.6%	9.5%	12.4%
Gizzard shad	6.9%	0.9%	4.1%	16.2%
Yellow perch	9.9%	12.8%	4.5%	8.6%
Warmouth	11.4%	8.5%	2.5%	7.5%
Redear	--	7.9%	6.0%	6.7%

5.0 Problem Statement

The composition and structure of the lake's rooted plant community often provide insight into the long term water quality of a lake. While sampling the lake water's chemistry (dissolved oxygen, nutrient concentrations, etc.) is important, water chemistry sampling offers a single snapshot of the lake's condition. Because rooted plants live for many years in a lake, the composition and structure of this community reflects the water quality of the lake over a longer term.

The composition and structure of a lake's rooted plant community also help determine the lake's fish community composition and structure. Submerged aquatic vegetation provides cover from predators and is a source of forage for many different species of fish (Valley et al., 2004). However, extensive and dense stands of exotic aquatic vegetation can have a negative impact on the fish community. For example, a lake's bluegill population can become stunted because dense vegetation reduces their foraging ability, resulting in slower growth. Additionally, dense stands reduce predation by largemouth bass and other piscivorous fish on bluegill which results in increased intraspecific competition among both prey and predator species (Olsen et al., 1998). Vegetation removal can have variable results on improving fish growth rates (Cross et al., 1992, Olsen et al., 1998). Conversely, lakes with depauperate plant communities may have difficulty supporting some top predators that require emergent vegetation for spawning. In these and other ways, the lake's rooted plant community illuminates possible reasons for a lake's fish community composition and structure.

A lake's rooted plant community impacts the recreational uses of the lake. Swimmers and power boaters desire lakes that are relatively plant-free, at least in certain portions of the lake. In contrast, anglers prefer lakes with adequate rooted plant coverage, since those lakes offer the best fishing opportunity. Before lake users can develop a realistic management plan for a lake, they must understand the existing rooted plant community and how to manage that community. This understanding is necessary to achieve the recreational goals lake users may have for a given lake.

5.1 Nuisance and Exotic Plants

Although they have not yet reached the levels observed on many other regional lakes, several nuisance and/or exotic aquatic plant species grow in the Barbee Lakes. As nuisance species, these species will continue to proliferate if unmanaged, so data collected during the plant survey will be outdated quickly and should not be used to precisely locate nuisance species individuals or stands. (Additionally, it is likely that the watershed supports many terrestrial nuisance species plant species, but the discussion in this report will focus on the aquatic nuisance species.) The plant survey revealed the presence of two submerged, aggressive exotics: Eurasian watermilfoil (Figure 8) and curly-leaf pondweed (Figure 9). The Barbee Lakes also supports two emergent exotic plant species: purple loosestrife (Figure 10) and reed canary grass (Figure 11). As exotic invasive species, these species also have the potential to proliferate if left unmanaged.



Figures 8. Eurasian watermilfoil (*Myriophyllum spicatum*) and 9. Curly-leaf pondweed (*Potamogeton crispus*).



Figure 10. Purple loosestrife (*Lythrum salicaria*) and Figure 11. Reed canary grass (*Phalaris arundinacea*).

5.1.1 Eurasian watermilfoil

The presence of Eurasian watermilfoil in the Barbee Lakes is of concern, but it is not uncommon for lakes in the region. Eurasian watermilfoil is an aggressive, non-native species common in northern Indiana lakes. It often grows in dense mats excluding the establishment of other plants. For example, once the plant reaches the water's surface, it will continue growing horizontally across the water's surface. This growth pattern has the potential to shade other submerged species preventing their growth and establishment. In addition, Eurasian watermilfoil does not provide the same habitat potential for aquatic fauna as many native pondweeds. Its leaflets serve as poor substrate for aquatic insect larvae, the primary food source of many panfish.

5.1.2 Curly-leaf pondweed

Depending upon water chemistry, curly-leaf pondweed can be more or less aggressive than Eurasian watermilfoil. Its presence in the lake is a concern because, like Eurasian watermilfoil, curly-leaf pondweed can spread across the lake's surface forming dense mats ultimately shading out native species. Like many exotic invasive species, curly-leaf pondweed gains a competitive advantage over native submerged species by sprouting early in the year. The species can do this because it is more tolerant of cooler water temperature than many of the native submerged species. Curly-leaf pondweed experiences a die-back during early to mid-summer. This die-back can degrade water quality by releasing nutrients into the water column and increasing the biological oxygen demand.

5.1.3 Purple loosestrife

Purple loosestrife is an aggressive, exotic species introduced into this country from Eurasia for use as an ornamental garden plant. Like Eurasian watermilfoil, purple loosestrife has the potential to dominate habitats, in this case wetland and shoreline communities, excluding native plants. The stiff, woody composition of purple loosestrife makes it a poor food source substitute for many of the native emergents it replaces. In addition, the loss of diversity that occurs as purple loosestrife takes over plant communities lowers the wetland and shoreline habitat quality for waterfowl, fishes, and aquatic insects.

5.1.4 Reed canary grass

Like purple loosestrife, reed canary grass is native to Eurasia. Farmers used (and many likely still use) the species for erosion control along ditch banks or as marsh hay. The species escaped via ditches and has spread to many of the wetlands in the area. Swink and Wilhelm (1994) indicate that reed canary grass commonly occurs at the toe of the upland slope around a wetland. Reed canary grass was often observed above the ordinary high water mark around the Barbee Lakes. Like other nuisance species, reed canary grass forms a monoculture mat excluding native wetland/shoreline plants. This limits a wetland's or shoreline's diversity ultimately impacting the habitat's functions.

5.1.5 Hydrilla

Although it was not identified in the Barbee Lakes during the aquatic plant survey, another exotic, invasive species, hydrilla, was identified for the first time in Indiana at Lake Manitou in Fulton County in 2006. Hydrilla is a submerged plant that resembles common waterweed. However, hydrilla can tolerate lower light levels and higher nutrient concentrations than most native aquatic species. Because of its special adaptations, hydrilla can live in deeper water and photosynthesize earlier in the morning than other aquatic species. Because of these factors, hydrilla is often present long before it becomes readily apparent. It often grows quickly below the water and becomes obvious only after out-competing other species and forming a monoculture. Dense mats of hydrilla often cause pH imbalances and temperature and dissolved oxygen fluctuations. This allows hydrilla to out-compete other aquatic-plant species and can cause imbalances in the fish community.

5.2 Exotic Plants in the Barbee Lakes

Previous aquatic plant assessments identified the predominance of curly-leaf pondweed and the presence of Eurasian watermilfoil as the two primary exotic nuisance species located within the Barbee Lakes. Following the 2005 assessment, a permit application was submitted to the IDNR to treat approximately 120 acres of curly-leaf pondweed and 45 acres of Eurasian watermilfoil. A similar permit application was submitted in 2006 for treatment of curly-leaf pondweed, Eurasian watermilfoil, eel grass, and algae. In 2005, 125 acres of curly-leaf pondweed treatment with Aquathol K occurred throughout the Barbee Lakes, while 80 acres of Eurasian watermilfoil were treated with 2,4-D. In 2006, 123 acres of curly-leaf pondweed treatment and 45 acres of Eurasian watermilfoil treatment occurred within the lakes chain. These species continue to be problematic throughout the areas previously identified.

6.0 Aquatic Vegetation Management Goals and Objectives

The BLA identified three management goals during the development of their initial aquatic plant management plan (Weed Patrol, 2005 draft). These goals fit into the three goals developed by the IDNR for aquatic plant communities within Indiana lakes. The objectives and actions used to meet the goals are discussed in the **Management Action Strategy Section**.

Aquatic Plant Management Goals:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species.
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant, fish and wildlife resources.

Historic treatment efforts support these three goals. Efforts to control the growth and spread of curly-leaf pondweed and Eurasian watermilfoil should eventually result in a stable, diverse, native aquatic plant community. Specific outcomes of the current year's treatment efforts will be discussed in further detail in subsequent sections.

7.0 Plant Management History

On May 10, 2007, Weed Patrol Inc. treated a total of 150 acres of curly-leaf pondweed. The water temperature was not recorded at the time of the curly-leaf treatment; however, the herbicide applicator estimates the water temperature to have measured 56 deg F (Tony Cunningham, Weed Patrol, Inc., personal communication). On June 12 and 13, 2007, Weed Patrol Inc. treated a total of 70 acres of Eurasian watermilfoil. Treatment occurred during sunny conditions (approximately 70°F) with a light wind. A third treatment occurred on various dates (May 16, 17, and 23; June 12, 13, and 18; July 26 and 29; and September 10, 2007) and targeted filamentous algae (approximately 249 acres). Figures 12 and 13 indicate the specific locations, plant species targeted, and size of area targeted during the aforementioned herbicide applications. In total, 150 acres of curly-leaf pondweed and 70 acres of Eurasian watermilfoil were treated in 2007. For selective Eurasian watermilfoil control, roughly 2 ppm of 2,4-D herbicide (approximately 1 gallon per acre depending on the depth and size of the area) was applied. Often an herbicide can be applied at a lighter rate when treating big areas. For curly-leaf pondweed control, 0.5 mg/L of Aquathol K herbicide was used (applied at a rate of approximately 1 gallon per acre). This low rate was used to control curly-leaf pondweed, which is more sensitive to Aquathol K, while not killing native pondweeds (Tony Cunningham, Weed Patrol, personal communication). For both treatments, herbicide was applied by making narrow passes through the treatment area. Filamentous algae were treated with copper sulfate at a rate of 2.6 lb/acre-foot.

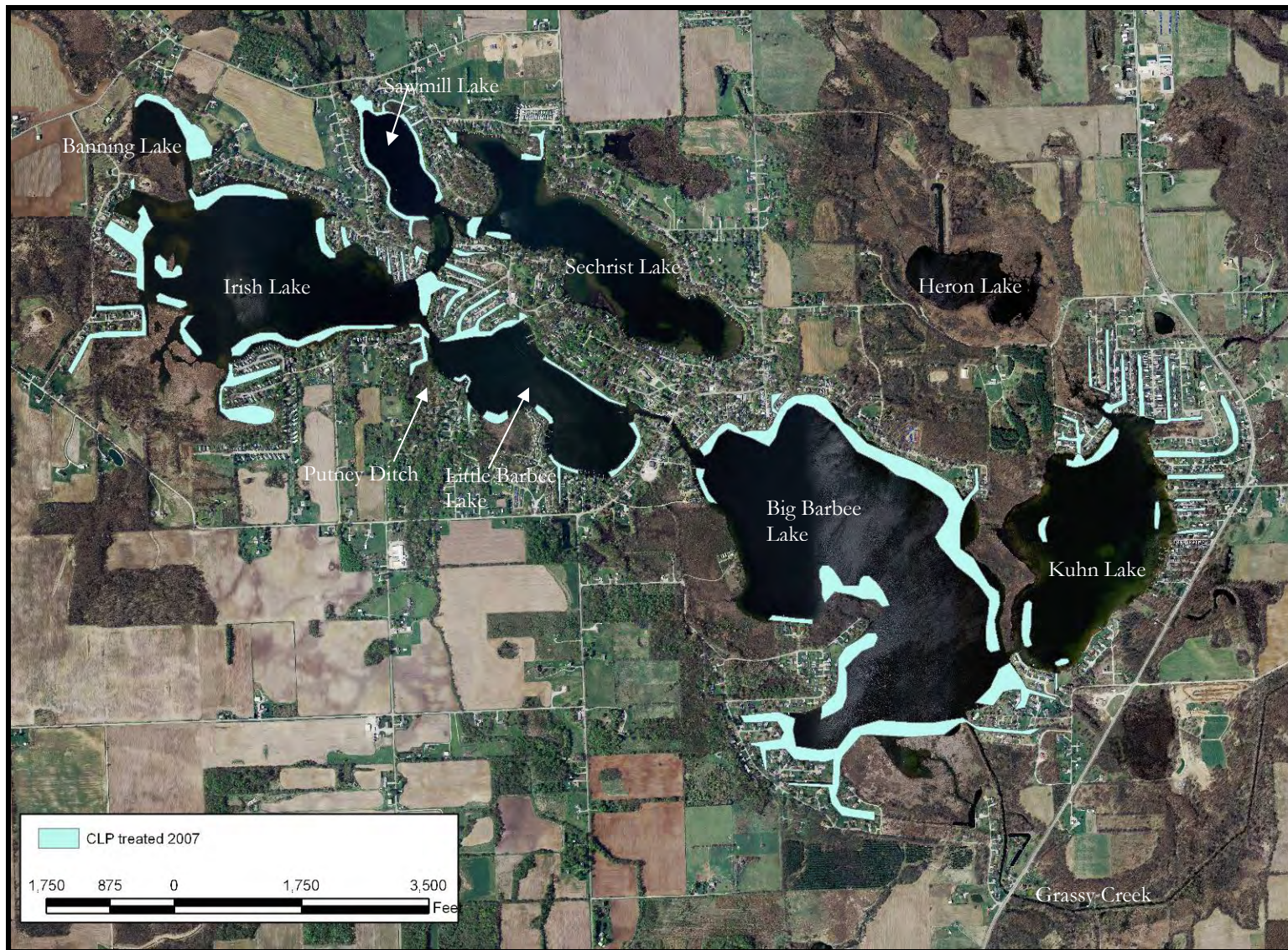


Figure 12. Curly-leaf pondweed (CLP) treatment areas located on Barbee Lakes.

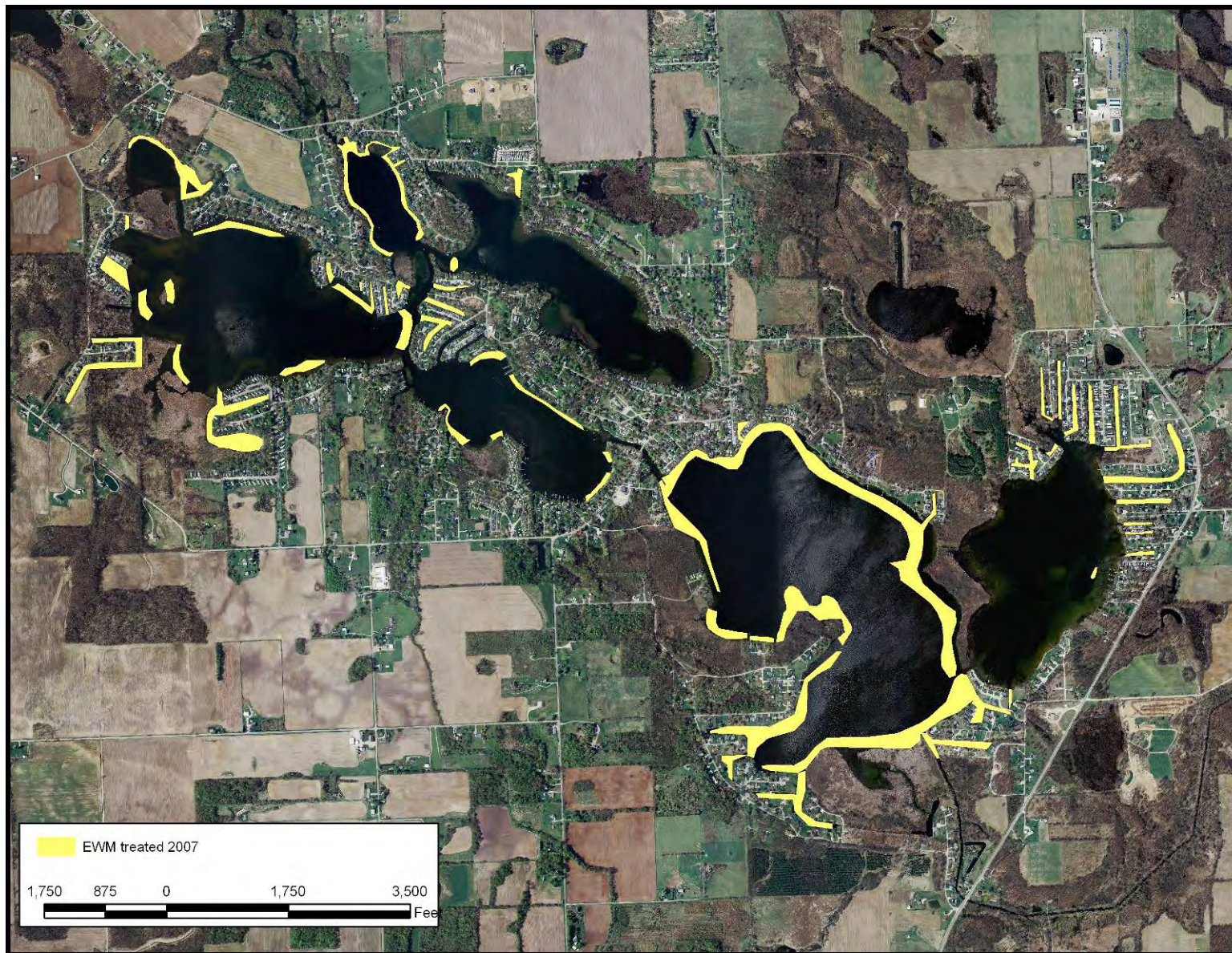


Figure 13. Eurasian watermilfoil (EWM) treatment areas located on Barbee Lakes.

8.0 Aquatic Plant Community Characterization

8.1 Methods

JFNew surveyed the Barbee Lakes' plant community twice: once for the spring survey on June 6 and 7, 2007 and once for the summer survey on August 8 and 24, 2007. Surveys were completed in accordance with the Indiana Department of Natural Resources sampling protocols (IDNR, 2007). JFNew examined the entire littoral zone of the lakes during each of the two assessments. Surveys were completed using the Tier II survey protocol updated by the IDNR LARE staff in May 2007 (IDNR, 2007). The survey protocol generally follows previous Tier II protocols and is most similar to the 2006 protocol, which requires that the sampling points be stratified over the entire depth of the lake's littoral zone. Total points sampled per stratum were determined as follows:

1. Appendix D of the survey protocol was consulted to determine the number of points to be sampled. This determination was based on the lake size (surface area) and trophic status.
2. Table 3 of the survey protocol was referenced as an indicator of the number of sample points per stratum. Table 4 in this report lists the sampling strategy for each of the lakes in the Barbee Lakes Chain.

Stratum refers to depth at which plants were observed. Dominance presented in subsequent tables was calculated by the IDNR protocol. The frequency per species presented in subsequent tables provides a measure of the frequency of a species sampled in each stratum. The percentage of plants found within a density measure indicates the frequency of plants found over all the sampling points.

Table 4. Tier II sampling strategy for the Barbee Lakes using the 2007 Tier II protocol.

Lake	Size	Trophic Status	Number of Points	Stratification of Points
Banning Lake	12 acres	Mesotrophic	30	10 pts 0-5 foot stratum 10 pts 5-10 foot stratum 7 pts 10-15 foot stratum 3 pts 15-20 foot stratum
Big Barbee Lake	304 acres	Eutrophic	70	37 pts 0-5 foot stratum 23 pts 5-10 foot stratum 10 pts 10-15 foot stratum
Irish Lake	182 acres	Hypereutrophic	50	40 pts 0-5 foot stratum 10 pts 5-10 foot stratum
Kuhn Lake	137 acres	Mesotrophic	50	14 pts 0-5 foot stratum 12 pts 5-10 foot stratum 12 pts 10-15 foot stratum 10 pts 15-20 foot stratum
Little Barbee Lake	74 acres	Eutrophic	40	17 pts 0-5 foot stratum 13 pts 5-10 foot stratum 10 pts 10-15 foot stratum
Sawmill Lake	74 acres	Hypereutrophic	40	30 pts 0-5 foot stratum 10 pts 5-10 foot stratum
Sechrist Lake	105 acres	Mesotrophic	50	14 pts 0-5 foot stratum 14 pts 5-10 foot stratum 12 pts 10-15 foot stratum 10 pts 15-20 foot stratum

The data from the surveys are used to calculate different lake characteristics and community and species metrics. The different characteristics and metrics calculated from the Tier II method are defined below:

- Littoral depth: Maximum depth that aquatic vegetation is present.
- Total sites: Total number of sites sampled.
- Littoral sites: Number of sites within the littoral depth.
- Secchi depth: Measurement of the transparency of water.
- Species richness: count of all submersed plant species collected.
- Native species richness: count of all native submersed plant species collected.
- Maximum number of species per site: highest number of species collected at any site.
- Mean number of species per site: The average number of all species collected per site.
- Mean number of native species per site: The average number of native species per site.
- Species diversity index: Modified Simpson's diversity index—a measure that provides a means of comparing plant community structure and stability over time.
- Frequency of occurrence: Measurement of the percentage of sampled sites where each species is present.
- Relative frequency of occurrence: Measures the distribution of plants occurrence throughout the lake in relation to each other.
- Dominance index: Combines the frequency of occurrence and relative density into a dominance value. This value characterizes how dominant a species is within the aquatic plant community (IDNR, 2007).

8.2 2007 Sampling Results

Spring (June) and summer (August) exotic species surveys and spring and summer Tier II surveys were completed on the Barbee Lakes in 2007 by JFNew. The survey schedule is detailed in Table 5. No samples were sent to an outside taxonomist for vouchering or identification. Additionally, two state threatened and one state rare species were collected during the surveys. The two state threatened species include Fries' pondweed (*Potamogeton friesii*) and white-stem pondweed (*Potamogeton praelongus*). The state rare species collected during the surveys was identified as Richardson's pondweed or Redheadgrass (*Potamogeton richardsonii*). These species are generally located within Kuhn and Sechrist lakes.

Table 5. Survey schedule for exotic species and Tier II surveys completed on the Barbee Lakes in 2007.

Survey	Date
<u>Spring exotic species and Tier II surveys:</u>	
Banning, Irish, Little Barbee, Sawmill, and Sechrist lakes	June 6, 2007
Big Barbee and Kuhn lakes	June 7, 2007
<u>Summer exotic species and Tier II surveys:</u>	
Big Barbee, Irish, Kuhn, and Little Barbee lakes	August 8, 2007
Banning, Sawmill, and Sechrist lakes	August 24, 2007

8.2.1 Exotic Species and Plant Community Mapping

Exotic species locations are shown in Figures 14 and 15. Additional plant community information is discussed in detail in the following sections. Figure 16 shows the sampling locations for the spring Tier II survey.

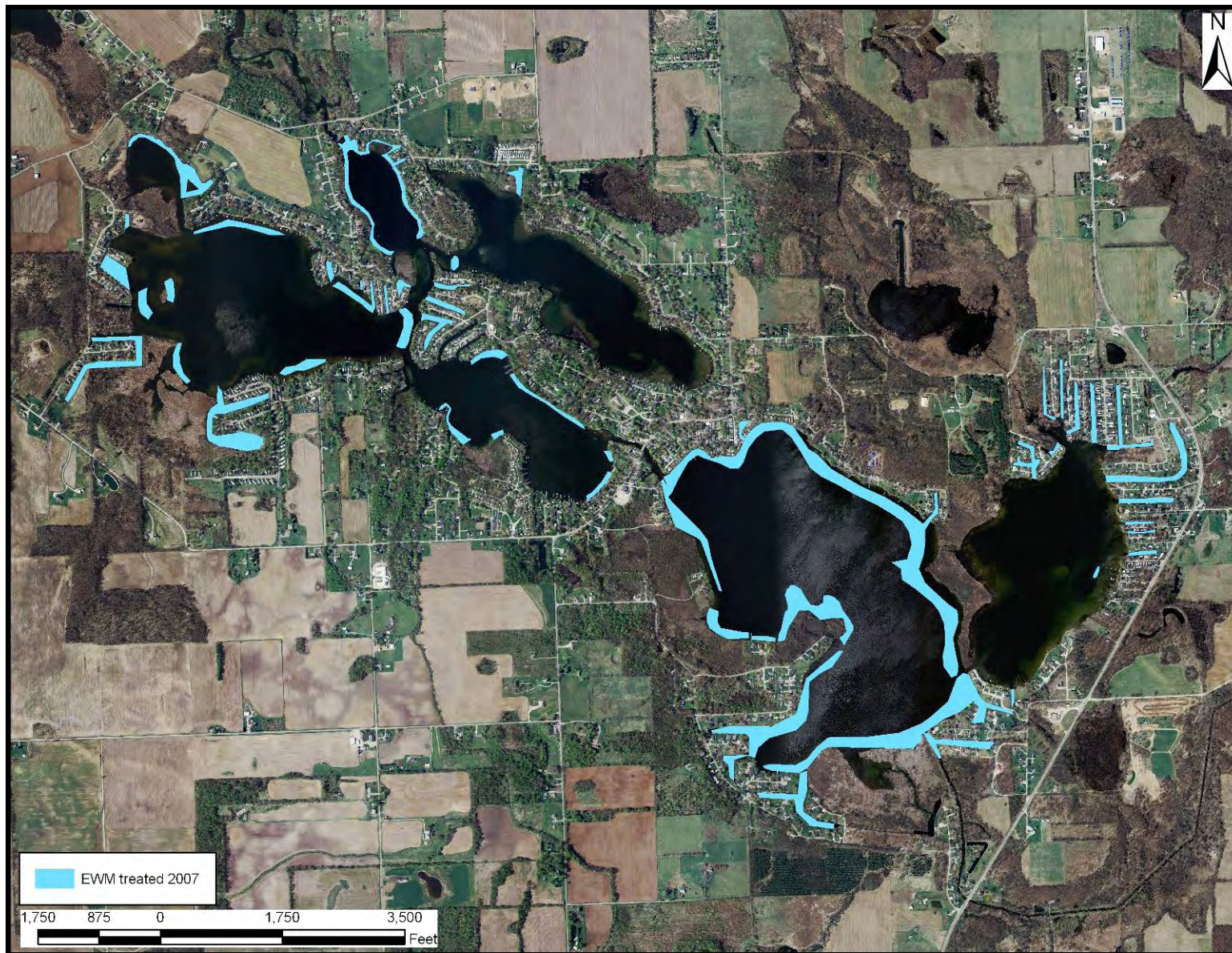


Figure 14. Eurasian watermilfoil plant beds identified in the Barbee Lakes Chain, June 6, June 7, August 8, and August 24, 2007.

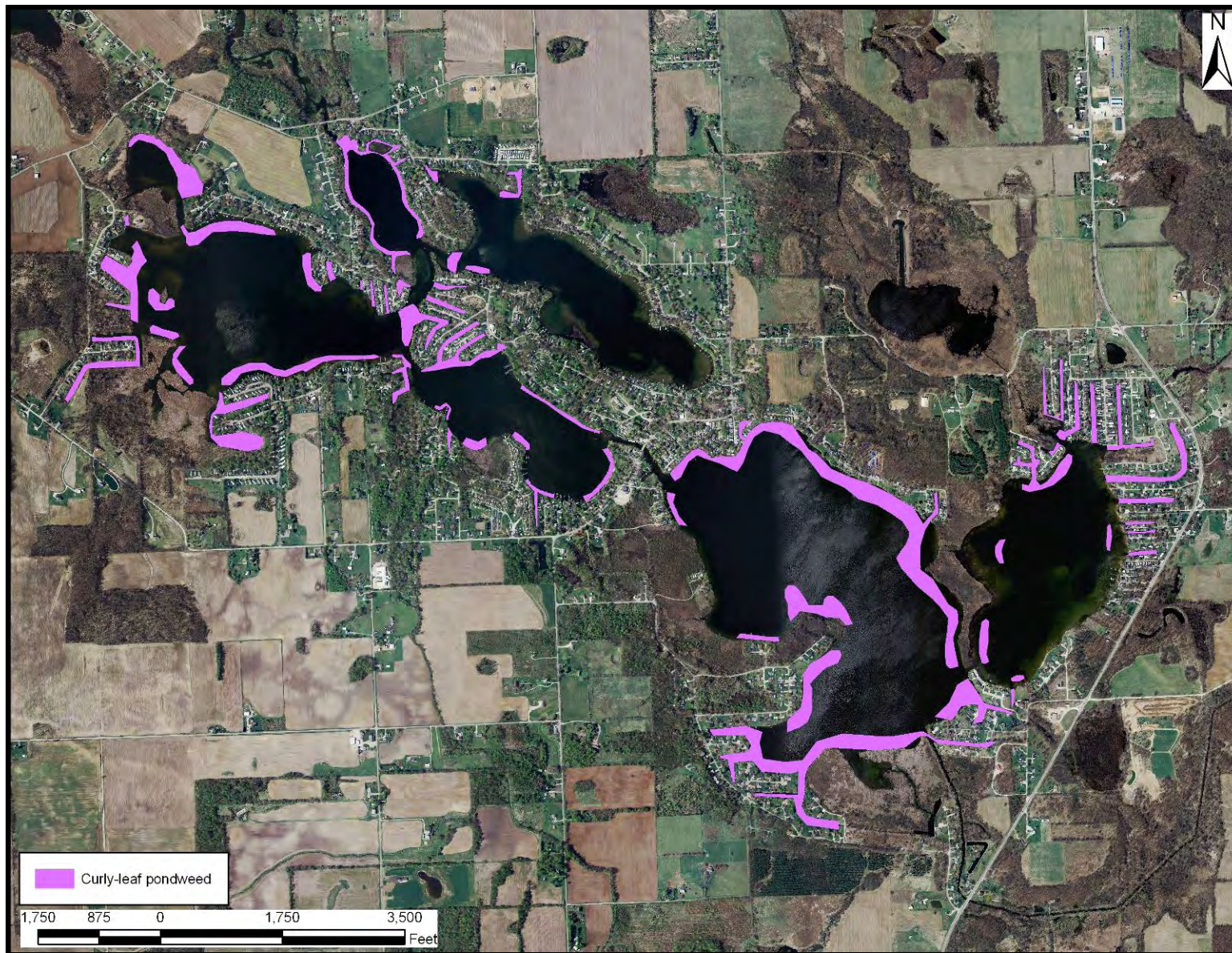


Figure 15. Curly-leaf pondweed plant beds identified in the Barbee Lakes Chain, June 6, June 7, August 8, and August 24, 2007.

Banning Lake

Spring Assessment

The dominant plant species found in Banning Lake are white water lily, spatterdock, chara, coontail, and Eurasian watermilfoil (Table 6). There are a few problem areas which are located throughout the lake. Rooted floating species (white water lily and spatterdock) covered much of the southern shoreline of the lake and continued in a narrow band around the eastern and western shorelines. Very narrow rooted-floating zones were present along Banning Lake's northern shoreline. Eurasian watermilfoil and coontail were located throughout the lake. Dense beds of Eurasian watermilfoil are mapped in Figure 14. In total, 21 species were identified in Banning Lake during the spring survey. Identified species represent all three strata (emergent, submerged, and floating). A majority of the identified species are submerged species including coontail, chara, three species of watermilfoil, curly-leaf pondweed, eel grass, and two bladderwort species. Seven emergent species, two rooted floating species, and algae were also identified in Banning Lake during the spring survey (Table 6).

Table 6. Aquatic plant species observed in Banning Lake during the spring and summer surveys completed June 6 and August 24, 2007.

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Ceratophyllum demersum</i>	Coontail	Submergent	X	X
<i>Chara</i> species	Chara species	Submergent	X	X
<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent	X	X
<i>Filamentous algae</i>	Filamentous algae	Algae	X	X
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	X	X
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	Submergent	X	
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	Submergent	X	
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent	X	X
<i>Najas guadalupensis</i>	Southern naiad	Submergent		X
<i>Nitella</i> species	Nitella species	Submergent	X	X
<i>Nuphar advena</i>	Spatterdock	Floating	X	X
<i>Nymphaea tuberosa</i>	White water lily	Floating	X	X
<i>Pontedaria cordata</i>	Pickrel weed	Emergent	X	X
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	X	
<i>Scirpus pungens</i>	Chairmaker's rush	Emergent	X	X
<i>Sparganium eurycarpum</i>	Broadfruit bur-reed	Emergent	X	X
<i>Stuckenia pectinatus</i>	Sago pondweed	Submergent	X	X
<i>Typha glauca</i>	Narrow-leaf cattail	Emergent	X	X
<i>Typha latifolia</i>	Broad-leaf cattail	Emergent	X	X
<i>Utricularia gibba</i>	Humped bladderwort	Submergent	X	X
<i>Utricularia vulgaris</i>	Common bladderwort	Submergent	X	X
<i>Vallisneria americana</i>	Eel grass	Submergent	X	

Summer Survey

Banning Lake's aquatic plant community changed little from the spring to the summer survey. Coontail, chara, white water lily, and spatterdock dominated the aquatic plant community during the summer survey. In total, 19 species were identified within Banning Lake during the summer survey.

The differences in the plant community can be attributed to water temperature preferences (curly-leaf pondweed) and limited dominance or frequency (northern watermilfoil, various-leaf watermilfoil, and eel grass) during the spring survey. Their presence during the spring survey was noted in limited locations, which may have not been identified during the summer survey. Additionally, Eurasian watermilfoil, which dominated the aquatic plant community during the spring survey, was identified in low dominance and in limited locations. These areas correspond with high density areas identified during the spring survey that are mapped in Figure 14. Curly-leaf pondweed was not identified in Banning Lake during the summer survey.

Big Barbee Lake

Spring Assessment

During the spring assessment, Big Barbee Lake contained a variety of plants that represent all three strata (submerged, floating, emergent). In total, 25 aquatic plant species were identified in Big Barbee Lake during the spring survey (Table 7). A majority of these species represent the submerged aquatic plant stratum. Additionally, pondweed species account for 3 of the 13 submerged species identified within Big Barbee Lake. Emergent species account for eight of the species identified in the lake, while rooted floating species account for two of the three floating species present in the lake. Rooted floating and emergent species were prevalent along the undeveloped shorelines of Big Barbee Lake. In these areas, emergent species lined the shoreline and rooted floating species extended 50 to 100 feet of the lake's shoreline. However, rooted floating and emergent species were generally absent from shorelines along residentially-developed areas of the lake. Overall, the dominant plant species found in Big Barbee Lake were coontail, Eurasian watermilfoil, and common waterweed (Table 7). There are a few problem areas which are located throughout the lake.

Four exotic species, reed canary grass, purple loosestrife, Eurasian watermilfoil, and curly-leaf pondweed, were identified within Big Barbee Lake. Both reed canary grass and purple loosestrife were limited to small clumps along the shoreline of Big Barbee Lake. Conversely, Eurasian watermilfoil and curly-leaf pondweed were relatively prevalent throughout the lake (Figures 14 and 15). Eurasian watermilfoil was identified throughout much of Big Barbee Lake during the spring survey, while smaller, more isolated areas of curly-leaf pondweed were identified during the spring assessment. However, it should be noted that these surveys were not conducted at the peak of curly-leaf pondweed growth. To adequately assess the dominance of curly-leaf pondweed, an assessment should be conducted in April or early May to adequately quantify the presence and location of curly-leaf pondweed within Big Barbee Lake.

Table 7. Aquatic plant species observed in Big Barbee Lake during the spring and summer surveys completed June 7 and August 8, 2007.

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Ceratophyllum demersum</i>	Coontail	Submergent	X	X
<i>Chara</i> species	Chara species	Submergent	X	X
<i>Elodea canadensis</i>	Common water weed	Submergent	X	X
<i>Elodea nuttallii</i>	Nuttall's water-weed	Submergent	X	X
<i>Filamentous algae</i>	Filamentous algae	Algae	X	X
<i>Hibiscus</i> species	Rosemallow species	Emergent	X	X
<i>Iris virginica</i>	Blue-flag iris	Emergent	X	X
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	X	X

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Myriophyllum exalbescent</i>	Northern watermilfoil	Submergent	X	X
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	Submergent	X	
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent	X	X
<i>Najas guadalupensis</i>	Southern naiad	Submergent	X	X
<i>Nuphar advena</i>	Spatterdock	Floating	X	X
<i>Nymphaea tuberosa</i>	White water lily	Floating	X	X
<i>Phalaris arundinacea</i>	Reed canary grass	Emergent	X	X
<i>Polygonum hydropiperoides</i>	Swamp smartweed	Emergent	X	X
<i>Pontedaria cordata</i>	Pickrel weed	Emergent	X	X
<i>Potamogeton crispus</i>	Curly leaf pondweed	Submergent	X	X
<i>Potamogeton friesii*</i>	Fries' pondweed	Submergent		X
<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent		X
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent	X	X
<i>Scirpus pungens</i>	Chairmaker's rush	Emergent	X	X
<i>Stuckenia pectinatus</i>	Sago pondweed	Submergent	X	X
<i>Typha latifolia</i>	Broad-leaf cattail	Emergent	X	X
<i>Utricularia vulgaris</i>	Common bladderwort	Submergent	X	X
<i>Vallisneria americana</i>	Eel grass	Submergent	X	X
<i>Wolffia columbiana</i>	Watermeal	Floating	X	X

*State threatened species

Summer Survey

In addition to the aquatic plants found during the spring survey, JFNew biologists identified two additional pondweed species: Fries' pondweed and Illinois pondweed. Fries' pondweed is considered a state threatened species. Additionally of note, Eurasian watermilfoil dominance decreased from spring to summer and was found in fewer locations than those identified during the spring survey. Eurasian watermilfoil was present during the summer survey in all areas identified during the spring survey. No curly-leaf pondweed was found in Big Barbee Lake during the summer survey.

Irish Lake

Spring Assessment

During the spring assessment, Irish Lake contained a variety of plants that represent all three strata (submerged, floating, emergent). In total, 23 aquatic plant species were identified in Irish Lake during the spring survey (Table 8). A majority of these species represent the submerged aquatic plant stratum. Pondweed species account for 6 of the 15 submerged species identified within Irish Lake. Pondweed species are typically considered to indicate higher water quality and better transparency than other aquatic plant species. Emergent species account for five of the species identified in the lake, while rooted floating species account for two of the aquatic species present in Irish Lake. Rooted floating and emergent species were prevalent along the undeveloped shorelines of Irish Lake and are particularly evident along the lake's northwest and southwest shorelines. In these areas, emergent species lined the shoreline and rooted floating species extended approximately 70 feet of the lake's shoreline. However, rooted floating and emergent species were generally absent from shorelines along residentially-developed areas of the lake. Overall, the dominant plant species found

in Irish Lake were chara, coontail, Eurasian watermilfoil, and eel grass (Table 8). There are a few problem areas which are located throughout the lake.

Four exotic species, reed canary grass, purple loosestrife, Eurasian watermilfoil, and curly-leaf pondweed, were identified within Irish Lake. Both reed canary grass and purple loosestrife were limited to small clumps along the shoreline of the lake. Conversely, Eurasian watermilfoil and curly-leaf pondweed were relatively prevalent throughout the lake (Figures 14 and 15). Eurasian watermilfoil was identified throughout much of Irish Lake during the spring survey and was particularly prevalent along developed shorelines. Curly-leaf pondweed was identified in smaller, more isolated locations along the lake's eastern, northern, and southern shorelines. As previously indicated, it should be noted that these surveys were not conducted at the peak of curly-leaf pondweed growth. To adequately assess the dominance of curly-leaf pondweed, an assessment should be conducted in April or early May to adequately quantify the presence and location of curly-leaf pondweed within Irish Lake.

Table 8. Aquatic plant species observed in Irish Lake during the spring and summer surveys completed June 6 and August 8, 2007.

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Ceratophyllum demersum</i>	Coontail	Submergent	X	X
<i>Chara</i> species	Chara species	Submergent	X	X
<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent	X	X
<i>Elodea canadensis</i>	Common waterweed	Submergent	X	X
<i>Filamentous algae</i>	Filamentous algae	Algae	X	X
<i>Heteranthera dubia</i>	Water star grass	Submergent		X
<i>Hibiscus</i> species	Rosemallow species	Emergent	X	X
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	X	X
<i>Myriophyllum exallescens</i>	Northern watermilfoil	Submergent	X	X
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	Submergent	X	X
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent	X	X
<i>Najas flexilis</i>	Slender naiad	Submergent		X
<i>Najas guadalupensis</i>	Southern naiad	Submergent	X	X
<i>Nuphar advena</i>	Spatterdock	Floating	X	X
<i>Nymphaea tuberosa</i>	White water lily	Floating	X	X
<i>Phalaris arundinacea</i>	Reed canary grass	Emergent	X	X
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	Submergent	X	X
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	X	
<i>Potamogeton friesii</i> *	Fries' pondweed	Submergent		X
<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent	X	X
<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent	X	X
<i>Potamogeton natans</i>	Floating-leaf pondweed	Submergent	X	X
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent	X	X
<i>Stuckenia pectinatus</i>	Sago pondweed	Submergent	X	X
<i>Typha latifolia</i>	Broad-leaf cattail	Emergent	X	X
<i>Utricularia vulgaris</i>	Common bladderwort	Submergent		X

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Vallisneria spiralis</i>	Eel grass	Submergent	X	X

*State threatened species

Summer Survey

In addition to the aquatic plants documented during the spring survey, JFNew biologists identified water star grass, slender naiad, common bladderwort, and Fries' pondweed during the summer survey. These species increased the diversity present in Irish Lake with a total of 26 species identified during the summer survey. Only one species, curly-leaf pondweed, identified during the spring survey was not found during the summer survey. Curly-leaf pondweed is known for its preference for cooler water temperatures; therefore, it is not surprising that curly-leaf pondweed was not identified during the summer aquatic plant survey of Irish Lake.

Kuhn Lake

Spring Assessment

During the spring assessment, Kuhn Lake contained a variety of plants that represent all three strata (submerged, floating, emergent). In total, 25 aquatic plant species were identified in Kuhn Lake during the spring survey (Table 9). A majority of these species represent the submerged aquatic plant stratum. Pondweed species account for 7 of the 17 submerged species identified within Kuhn Lake. As previously indicated, pondweed species are typically considered to indicate higher water quality and better transparency than other aquatic plant species. Emergent species account for five of the species identified in the lake, while rooted floating species account for two of the aquatic species present in Kuhn Lake. Rooted floating and emergent species were prevalent along the undeveloped western shoreline of Kuhn Lake. In this area, emergent species lined the shoreline and rooted floating species extended approximately 30 feet off of the lake's shoreline. As this shoreline is relatively shallow, submerged species proliferate on this shelf extending across much of the lake's surface. Overall, the dominant plant species found in Kuhn Lake were various-leaf watermilfoil, curly-leaf pondweed, white-stem pondweed, white water lily and chara (Table 9). There are a few problem areas which are located throughout the lake. Overall, Kuhn Lake possesses one of the highest quality aquatic plant communities within the Barbee Lakes Chain. This is evident in its rich and varied community and can likely be attributed to the better than average water clarity and relatively isolated and small watershed in which Kuhn Lake sits.

Two exotic species, Eurasian watermilfoil, and curly-leaf pondweed, were identified within Kuhn Lake. Curly-leaf pondweed was scattered throughout the lake and was relatively pervasive in Kuhn Lake's man-made channels during the spring survey (Figure 15). Conversely, Eurasian watermilfoil was limited to relatively isolated locations within the man-made channels along the lake's eastern shoreline (Figure 14). As previously indicated, it should be noted that these surveys were not conducted at the peak of curly-leaf pondweed growth. To adequately assess the dominance of curly-leaf pondweed, an assessment should be conducted in April or early May to adequately quantify the presence and location of curly-leaf pondweed within Kuhn Lake.

Table 9. Aquatic plant species observed in Kuhn Lake during the spring and summer surveys completed June 7 and August 8, 2007.

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Ceratophyllum demersum</i>	Coontail	Submergent	X	X

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Chara</i> species	Chara species	Submergent	X	X
<i>Elodea canadensis</i>	Common waterweed	Submergent	X	X
<i>Filamentous algae</i>	Filamentous algae	Algae	X	X
<i>Hibiscus</i> species	Rosemallow species	Emergent	X	X
<i>Iris virginica</i>	Blueflag iris	Emergent	X	X
<i>Myriophyllum exalbescent</i>	Northern watermilfoil	Submergent		X
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	Submergent	X	X
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent	X	X
<i>Najas guadalupensis</i>	Southern naiad	Submergent	X	X
<i>Nitella</i> species	Nitella species	Submergent	X	X
<i>Nuphar advena</i>	Spatterdock	Floating	X	X
<i>Nymphaea tuberosa</i>	White water lily	Floating	X	X
<i>Polygonum hydropiperoides</i>	Swamp smartweed	Emergent	X	X
<i>Pontedaria cordata</i>	Pickrel weed	Emergent	X	X
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	Submergent	X	X
<i>Potamogeton berchtoldii</i>	Small pondweed	Submergent		X
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	X	
<i>Potamogeton foliosus</i>	Leafy pondweed	Submergent		X
<i>Potamogeton friesii</i>	Fries' pondweed	Submergent	X	X
<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent	X	X
<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent	X	X
<i>Potamogeton nodosus</i>	Long-leaf pondweed	Submergent		X
<i>Potamogeton praelongus</i> *	White-stem pondweed	Submergent	X	X
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent	X	X
<i>Scirpus pungens</i>	Chairmaker's rush	Emergent	X	X
<i>Stuckenia pectinatus</i>	Sago pondweed	Submergent	X	X
<i>Utricularia vulgaris</i>	Common bladderwort	Submergent	X	X
<i>Vallisneria americana</i>	Eel grass	Submergent	X	X

*State threatened species

Summer Survey

In addition to the aquatic plants documented during the spring survey, JFNew biologists identified three additional pondweed species: long-leaf, leafy, and small pondweed, and northern watermilfoil during the summer survey. These species increased the diversity present in Kuhn Lake to a total of 29 species identified during the summer survey. Only one species, curly-leaf pondweed, identified during the spring survey was not found during the summer survey. Curly-leaf pondweed is known for its preference for cooler water temperatures; therefore, it is not surprising that curly-leaf pondweed was not identified during the summer aquatic plant survey of Kuhn Lake.

Little Barbee Lake

Spring Assessment

During the spring assessment, Little Barbee Lake contained a variety of plants that represent all three strata (submerged, floating, emergent). In total, 18 aquatic plant species were identified in Little

Barbee Lake during the spring survey (Table 10). A majority of these species represent the submerged aquatic plant stratum. In total, eight submerged species were identified within Little Barbee Lake during the spring survey. Coontail, Eurasian watermilfoil, and common waterweed were the most abundant species identified. Most submerged species were present in very dense growth patterns. Additionally, although a relatively diverse group of species were identified, those species present are relatively tolerant species. This community reflects the relatively poor water quality present in Little Barbee Lake and the lake's high nutrient loading (JFNew, 2000). Emergent species accounted for seven of the species identified in the lake, while rooted floating species account for two of the aquatic species present in Little Barbee Lake. Rooted floating and emergent species were prevalent along the undeveloped western shoreline of Little Barbee Lake. Most emergent and rooted-floating plant growth occurred in the cove along the lake's southern shoreline and near the east and west ends of the lake along the southern shoreline. There are a few problem areas which are located throughout the lake.

Four exotic species, purple loosestrife, reed canary grass, Eurasian watermilfoil, and curly-leaf pondweed, were identified within Little Barbee Lake. Both reed canary grass and purple loosestrife were limited to small clumps along the shoreline of the lake. Conversely, Eurasian watermilfoil and curly-leaf pondweed were relatively prevalent throughout the lake (Figures 14 and 15). Both curly-leaf pondweed and Eurasian watermilfoil were identified throughout much of Little Barbee Lake during the spring survey and were particularly prevalent along developed shorelines. As previously indicated, it should be noted that these surveys were not conducted at the peak of curly-leaf pondweed growth. To adequately assess the dominance of curly-leaf pondweed, an assessment should be conducted in April or early May to adequately quantify the presence and location of curly-leaf pondweed within Little Barbee Lake.

Table 10. Aquatic plant species observed in Little Barbee Lake during the spring and summer surveys completed June 6 and August 8, 2007.

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Ceratophyllum demersum</i>	Coontail	Submergent	X	X
<i>Chara</i> species	Chara species	Submergent	X	X
<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent	X	X
<i>Elodea canadensis</i>	Common waterweed	Submergent	X	X
<i>Filamentous algae</i>	Filamentous algae	Algae	X	X
<i>Hibiscus</i> species	Rosemallow species	Emergent	X	X
<i>Iris virginica</i>	Virginia blueflag	Emergent	X	X
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	X	X
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	Submergent		X
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent	X	X
<i>Najas guadalupensis</i>	Southern naiad	Submergent		X
<i>Nuphar advena</i>	Spatterdock	Floating	X	X
<i>Nymphaea tuberosa</i>	White water lily	Floating	X	X
<i>Phalaris arundinacea</i>	Reed canary grass	Emergent	X	X
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	X	
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent	X	X
<i>Scirpus pungens</i>	Chairmaker's rush	Emergent	X	X

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Stuckenia pectinatus</i>	Sago pondweed	Submergent	X	X
<i>Typha latifolia</i>	Broad-leaf cattail	Emergent	X	X
<i>Utricularia vulgaris</i>	Common bladderwort	Submergent		X
<i>Vallisneria americana</i>	Eel grass	Submergent	X	

Summer Survey

In addition to the aquatic plants documented during the spring survey, JFNew biologists identified common bladderwort, southern naiad, and northern watermilfoil during the summer survey. These species increased the diversity present in Little Barbee Lake to a total of 19 species identified during the summer survey. Two species, eel grass and curly-leaf pondweed, identified during the spring survey were not found during the summer survey. Curly-leaf pondweed is known for its preference for cooler water temperatures; therefore, it is not surprising that curly-leaf pondweed was not identified during the summer aquatic plant survey of Little Barbee Lake.

Sawmill Lake

Spring Assessment

During the spring assessment, Sawmill Lake contained a variety of plants that represent all three strata (submerged, floating, emergent). In total, 19 aquatic plant species were identified in Sawmill Lake during the spring survey (Table 11). A majority of these species represent the emergent aquatic plant stratum. In total, eight emergent species were identified within Sawmill Lake during the spring survey. Only six submerged species were identified in Sawmill Lake during the spring survey. Coontail, Eurasian watermilfoil, curly-leaf pondweed, white water lily, and common waterweed were the most abundant species identified. Most submerged species were present in very dense growth patterns. Additionally, the species present are relatively tolerant species. This community reflects the relatively poor water quality present in Sawmill Lake and the lake's high nutrient loading (JFNew, 2000). Rooted floating species account for four of the aquatic species present in Sawmill Lake. Rooted floating and emergent species were prevalent along the undeveloped southern shoreline of Sawmill Lake. There are a few problem areas which are located throughout the lake.

Three exotic species, purple loosestrife, Eurasian watermilfoil, and curly-leaf pondweed, were identified within Sawmill Lake. Purple loosestrife was limited to small clumps along the shoreline of the lake. Conversely, Eurasian watermilfoil and curly-leaf pondweed were relatively prevalent throughout the lake (Figures 14 and 15). Both curly-leaf pondweed and Eurasian watermilfoil were identified throughout much of Sawmill Lake during the spring survey and were particularly prevalent along nearly the entire shoreline. Only the natural shoreline along the southern portion of the lake was absent of curly-leaf pondweed or Eurasian watermilfoil. As previously indicated, it should be noted that these surveys were not conducted at the peak of curly-leaf pondweed growth. To adequately assess the dominance of curly-leaf pondweed, an assessment should be conducted in April or early May to adequately quantify the presence and location of curly-leaf pondweed within Sawmill Lake.

Table 11. Aquatic plant species observed in Sawmill Lake during the spring and summer surveys completed June 6 and August 24, 2007.

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Ceratophyllum demersum</i>	Coontail	Submergent	X	X

Scientific Name	Common Name	Stratum	Spring	Summer
<i>Chara</i> species	Chara species	Submergent	X	X
<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent	X	X
<i>Elodea canadensis</i>	Common waterweed	Submergent	X	X
<i>Filamentous algae</i>	Filamentous algae	Algae	X	X
<i>Hibiscus</i> species	Rosemallow species	Emergent	X	X
<i>Lemna minor</i>	Duckweed	Floating	X	X
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	X	X
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent	X	X
<i>Najas flexilis</i>	Slender naiad	Submergent		X
<i>Najas guadalupensis</i>	Southern naiad	Submergent	X	X
<i>Nuphar advena</i>	Spatterdock	Floating	X	X
<i>Nymphaea tuberosa</i>	White water lily	Floating	X	X
<i>Polygonum hydropiperoides</i>	Swamp smartweed	Emergent	X	X
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	X	
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent		X
<i>Scirpus fluviatilis</i>	River bulrush	Emergent	X	X
<i>Scirpus pungens</i>	Chairmaker's rush	Emergent	X	X
<i>Sparganium eurycarpum</i>	Broadfruit bur-reed	Emergent	X	X
<i>Stuckenia pectinatus</i>	Sago pondweed	Submergent	X	X
<i>Typha latifolia</i>	Broad-leaf cattail	Emergent	X	X
<i>Utricularia vulgaris</i>	Common bladderwort	Submergent		X
<i>Wolffia columbiana</i>	Watermeal	Floating	X	X

Summer Survey

In addition to the aquatic plants documented during the spring survey, JFNew biologists identified common bladderwort, slender naiad, and flat-stem pondweed in Sawmill Lake during the summer survey. These species increased the diversity present in Sawmill Lake to a total of 21 species identified during the summer survey. One species, curly-leaf pondweed, identified during the spring survey was not found during the summer survey. Curly-leaf pondweed is known for its preference for cooler water temperatures; therefore, it is not surprising that curly-leaf pondweed was not identified during the summer aquatic plant survey of Sawmill Lake.

Sechrist Lake

Spring Assessment

During the spring assessment, Sechrist Lake contained a variety of plants that represent all three strata (submerged, floating, emergent). In total, 40 aquatic plant species were identified in Sechrist Lake during the spring survey (Table 12). A majority of these species represent the submerged aquatic plant stratum. Pondweed species account for 9 of the 19 submerged species identified within Sechrist Lake. As previously indicated, pondweed species are typically considered to indicate higher water quality and better transparency than other aquatic plant species. Emergent species account for eight of the species identified in the lake, while rooted floating species account for two of the aquatic species present in Sechrist Lake. Like other lakes in the chain, rooted floating and emergent species were prevalent along the undeveloped western shoreline of Sechrist Lake. Additionally, emergent

and rooted floating species occur around the shallow island present along the lake's southern shoreline. Overall, the dominant plant species found in Sechrist Lake were various-leaf watermilfoil, eel grass, white water lily, spatterdock, curly-leaf pondweed, coontail, and chara (Table 12). There are a few problem areas which are located throughout the lake. Overall, Sechrist Lake possesses one of the highest quality aquatic plant communities within the Barbee Lakes Chain. This is evident in its rich and varied community and can likely be attributed to the better than average water clarity and relatively isolated and small watershed in which Sechrist Lake sits.

Three exotic species, purple loosestrife, Eurasian watermilfoil, and curly-leaf pondweed, were identified within Sechrist Lake. Purple loosestrife was limited to small clumps along the shoreline of the lake. Likewise, Eurasian watermilfoil and curly-leaf pondweed were relatively isolated within Sechrist Lake (Figures 14 and 15). Both curly-leaf pondweed and Eurasian watermilfoil were identified within the channel along the lake's northern shoreline on the west end of Sechrist Lake. Two other relatively isolated populations of curly-leaf pondweed were identified near the west end of the lake, while one isolated population of Eurasian watermilfoil was identified immediately east of the channel connecting Sechrist Lake with Sawmill and Irish lakes. As previously indicated, it should be noted that these surveys were not conducted at the peak of curly-leaf pondweed growth. To adequately assess the dominance of curly-leaf pondweed, an assessment should be conducted in April or early May to adequately quantify the presence and location of curly-leaf pondweed within Sechrist Lake.

Table 12. Aquatic plant species observed in Sechrist Lake during the spring and summer surveys completed June 6 and August 24, 2007.

Scientific Name	Common Name	Stratum	Secchrist	Summer
<i>Asclepia incarnate</i>	Swamp milkweed	Emergent	X	X
<i>Cephalanthus occidentalis</i>	Buttonbush	Emergent	X	X
<i>Ceratophyllum demersum</i>	Coontail	Submergent	X	X
<i>Chara species</i>	Chara species	Submergent	X	X
<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent	X	X
<i>Filamentous algae</i>	Filamentous algae	Algae	X	X
<i>Heteranthera dubia</i>	Water star grass	Submergent		X
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	X	X
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	Submergent	X	
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	Submergent	X	X
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent	X	X
<i>Najas flexilis</i>	Slender naiad	Submergent		X
<i>Najas guadalupensis</i>	Southern naiad	Submergent	X	X
<i>Nitella species</i>	Nitella species	Submergent	X	
<i>Nuphar advena</i>	Spatterdock	Floating	X	X
<i>Nyphaea tuberosa</i>	White water lily	Floating	X	X
<i>Polygonum hydropiperoides</i>	Swamp smartweed	Emergent	X	X
<i>Pontedaria cordata</i>	Pickeral weed	Emergent	X	X
<i>Potamogeton berchtoldii</i>	Small pondweed	Submergent	X	X
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	X	

Scientific Name	Common Name	Stratum	Secchrist	Summer
<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent	X	X
<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent	X	X
<i>Potamogeton nodosus</i>	Long-leaf pondweed	Submergent	X	X
<i>Potamogeton praelongus</i> *	White-stem pondweed	Submergent	X	X
<i>Potamogeton richardsonii</i> **	Richardson's pondweed	Submergent	X	X
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent	X	X
<i>Scirpus acutis</i>	Soft-stem bulrush	Emergent	X	X
<i>Stuckenia pectinatus</i>	Sago pondweed	Submergent	X	X
<i>Typha latifolia</i>	Broad-leaf cattail	Emergent	X	X
<i>Vallisneria americana</i>	Eel grass	Submergent	X	X

*State threatened species; **State rare species

Summer Survey

In addition to the aquatic plants documented during the spring survey, JFNew biologists identified water star grass and slender naiad during the summer survey. These species increased the diversity present in Sechrist Lake to a total of 39 species identified during the summer survey. Two species, northern watermilfoil and curly-leaf pondweed, identified during the spring survey was not found during the summer survey. Curly-leaf pondweed is known for its preference for cooler water temperatures; therefore, it is not surprising that curly-leaf pondweed was not identified during the summer aquatic plant survey of Sechrist Lake.

8.2.2 Tier II

Two Tier II surveys were completed on lakes in the Barbee Lakes Chain in order to document changes in the plant community throughout the growing season. The Tier II surveys were completed on June 6 and 7, 2007 (spring) and on August 8 and 24, 2007 (summer). Spring and summer survey points occurred at approximately the same locations. The raw datasets are included in Appendix B, while the complete results are included in Appendix C.

Spring Survey

During the spring survey, coontail dominated the plant community present throughout the entire Barbee Lakes Chain. Coontail occurred at 55% of the sites and was nearly twice as dominant as any other species identified in the lakes (Table 13). Eurasian watermilfoil and chara were also relatively frequent occurring at 35% and 32% of sites, respectively. Their dominance was also relatively high when compared with other species in the lakes chain measuring 19.7 and 14.5, respectively. Other species that were present in multiple lakes in the chain, such as various-leaf watermilfoil, curly-leaf pondweed, eel grass, common waterweed, and sago pondweed were also relatively frequent in the chain occurring at 9% to 28% of the sampled sites. Plants that were less common in each lake or occurred only in a limited number of lakes were overall both less frequent and less dominant. For instance, nitella, white-stem pondweed, Nuttall's waterweed, and floating-leaf pondweed, which each occurred within a maximum of two lakes, are overall less frequent and less dominant than the more pervasive plants. Table 13 details aquatic plant species identified within the Barbee Lakes Chain during the spring survey, while Figures 16 through 18 detail the sampling locations and locations of exotic species, specifically Eurasian watermilfoil and curly-leaf pondweed, within the Barbee Lakes.

Table 13. Barbee Lakes spring Tier II survey metrics and results as collected June 6 and 7, 2007.

Occurrence and abundance of submersed aquatic plant species in the Barbee Lakes.							
Total Sites:	330	Mean species / site:	2.71	Native diversity:	0.87		
Littoral Sites:	328	Maximum species / site:	8	Species diversity:	0.90		
Littoral Depth (ft):	20	Number of species:	20	SE Mean natives / site:	0.08		
Date:	6/6,7/2007	Littoral sites with plants:	300	Mean natives / site:	2.09		
Lake:	Barbee Lakes	Secchi(ft):	N/A	SE Mean species / site:	0.09		
All depths (0-20')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	55.45	44.55	18.48	13.03	23.94	35.45
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	34.85	65.15	15.15	7.58	12.12	19.70
<i>Chara</i> species	Chara species	32.42	67.58	18.48	7.88	6.06	14.48
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	20.00	80.00	9.39	3.94	6.67	10.91
<i>Potamogeton crispus</i>	Curly-leaf pondweed	27.27	72.73	23.03	3.03	1.21	7.64
<i>Vallisneria americana</i>	Eel grass	24.24	75.76	19.09	4.24	0.91	7.27
<i>Elodea canadensis</i>	Common water weed	15.15	84.85	8.48	3.64	3.03	6.91
<i>Stuckenia pectinatus</i>	Sago pondweed	9.09	90.91	7.58	1.21	0.30	2.55
<i>Nitella</i> species	Nitella species	5.45	94.55	3.94	0.30	1.21	2.18
<i>Potamogeton richardsonii</i>	Richardson's pondweed	3.33	96.67	0.61	1.82	0.91	2.12
<i>Najas guadalupensis</i>	Southern naiad	9.09	90.91	8.48	0.61	0.00	2.06
<i>Potamogeton illinoensis</i>	Illinois pondweed	7.58	92.42	6.97	0.30	0.30	1.88
<i>Potamogeton nodosus</i>	Long-leaf pondweed	6.36	93.64	5.15	1.21	0.00	1.76
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	4.55	95.45	3.03	1.21	0.30	1.64
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	5.45	94.55	4.85	0.30	0.30	1.45
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	3.94	96.06	3.64	0.30	0.00	0.91
<i>Utricularia vulgaris</i>	Common bladderwort	3.03	96.97	2.73	0.30	0.00	0.73
<i>Potamogeton gramineus</i>	Grassy pondweed	3.03	96.97	3.03	0.00	0.00	0.61
<i>Potamogeton natans</i>	Floating-leaf pondweed	0.30	99.70	0.30	0.00	0.00	0.06
<i>Elodea nuttallii</i>	Nuttall's water-weed	0.30	99.70	0.30	0.00	0.00	0.06
<i>Filamentous algae</i>	Filamentous algae	47.88					



Figure 16. Sampling locations for the June 7 and 8, 2007 Tier II survey at the Barbee Lakes.

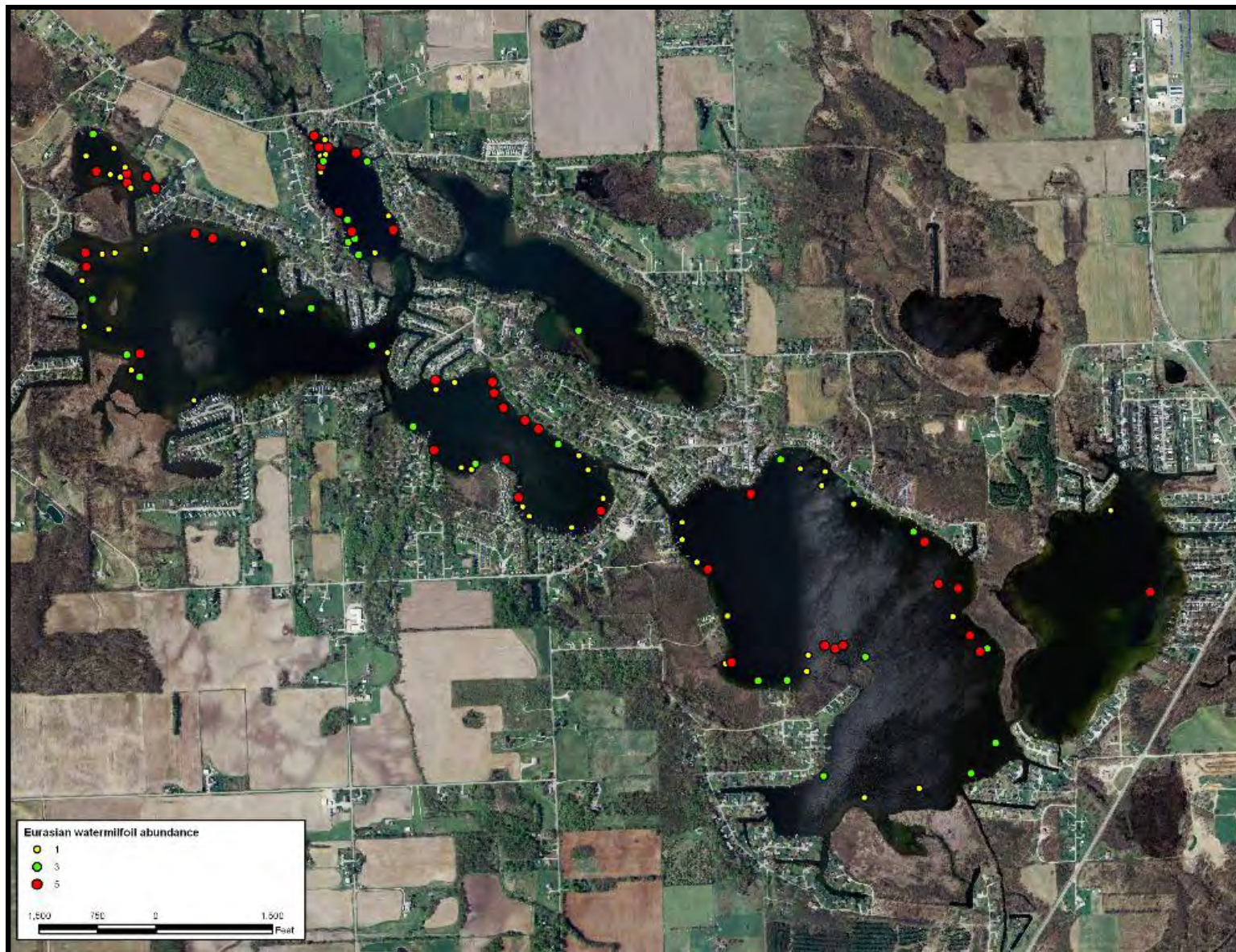


Figure 17. Barbee Lakes Eurasian watermilfoil locations and dominance as surveyed June 7 and 8, 2007.

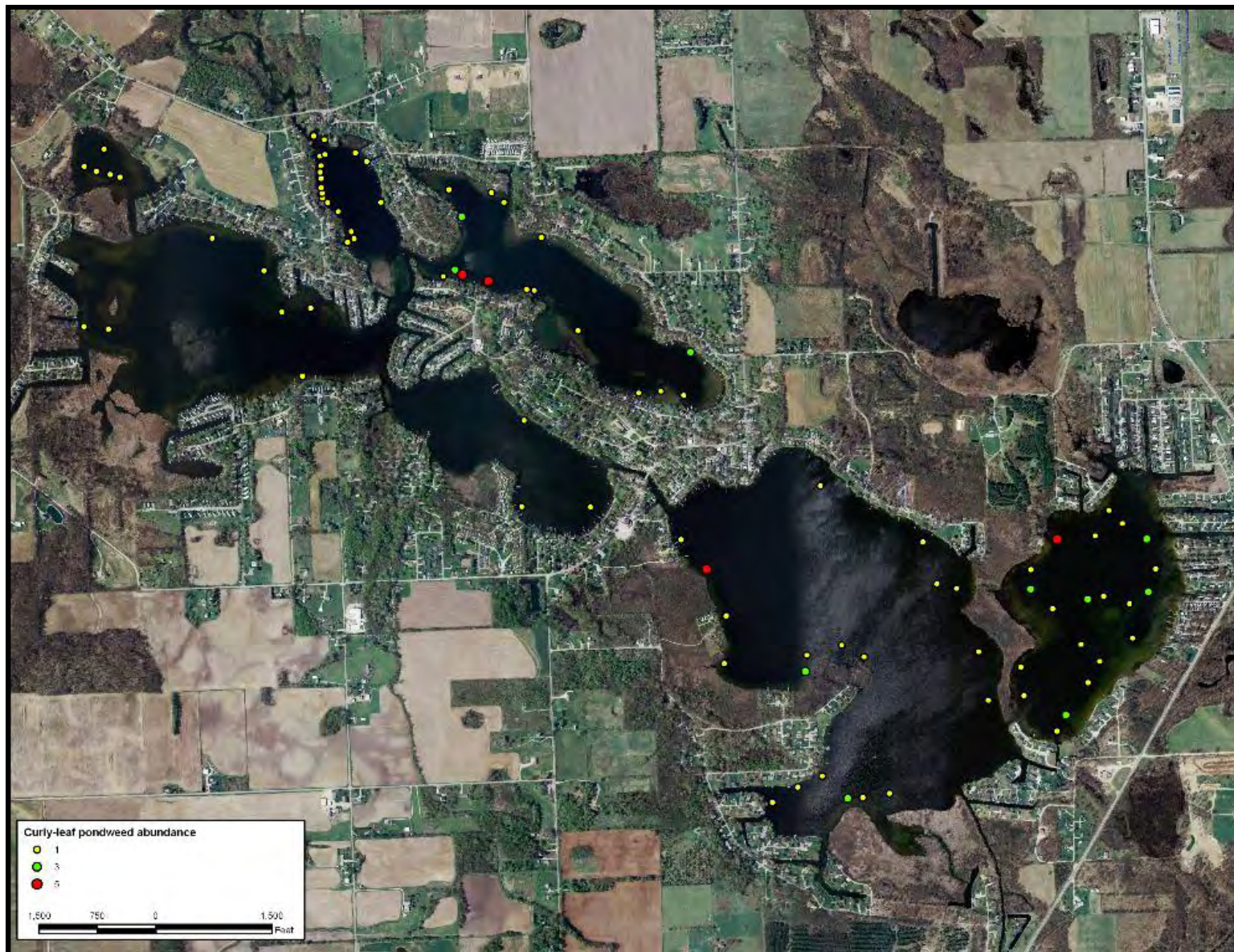


Figure 18. Barbee Lakes curly-leaf pondweed locations and dominance as surveyed June 7 and 8, 2007.

Summer Survey

During the summer survey, coontail again dominated the plant community present throughout the entire Barbee Lakes Chain. Coontail occurred at 58% of the sites and was nearly four times as dominant as any other species identified in the lakes (Table 14). Chara, eel grass, sago pondweed, southern naiad, and various-leaf watermilfoil were also relatively frequent occurring at 20%, 20%, 18%, 15%, and 15% of the sites, respectively. Their dominance was also relatively high when compared with other species in the lakes chain measuring between 4.0 and 10.7. All other species present throughout the lake chain occurred in relatively low frequencies and dominances. Overall, coontail's frequency and dominance remained relatively similar throughout the growing season. Other species increased in frequency throughout the summer including sago pondweed, white-stem pondweed, grassy pondweed, and southern naiad. Other species declined in frequency namely curly-leaf pondweed and Eurasian watermilfoil. Table 14 details aquatic plant species identified within the Barbee Lakes Chain during the summer survey, while Figure 19 details the sampling locations and Figure 20 indicates locations of the exotic species, Eurasian watermilfoil, within the Barbee Lakes. Curly-leaf pondweed was not found during the summer Tier II surveys. Maps detailing other species locations are included in Appendix D.

Table 14. Barbee Lakes summer Tier II survey metrics and results as collected August 8 and 24, 2007.

Occurrence and abundance of submersed aquatic plants in the Barbee Lakes.							
Total Sites:	330	Mean species / site:	2.06	Native diversity:	0.86		
Littoral Sites:	330	Maximum species / site:	8	Species diversity:	0.87		
Littoral Depth (ft):	20	Number of species:	24	SE Mean natives / site:	0.08		
Date:	8/8,24/07	Littoral sites with plants:	297	Mean natives / site:	1.98		
Lake:	Barbee Lakes	Secchi(ft):	N/A	SE Mean species / site:	0.08		
All depths (0-20')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	58.79	41.21	19.70	13.94	25.15	37.45
<i>Chara</i> species	Chara species	20.30	79.70	7.88	8.18	4.24	10.73
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	14.55	85.45	6.97	4.24	3.33	7.27
<i>Stuckenia pectinatus</i>	Sago pondweed	18.48	81.52	13.64	3.33	1.52	6.24
<i>Najas guadalupensis</i>	Southern naiad	15.15	84.85	13.03	1.82	0.30	4.00
<i>Nitella</i> species	Nitella species	6.67	93.33	4.85	0.30	1.52	2.67
<i>Elodea canadensis</i>	Common water weed	5.45	94.55	3.33	1.52	0.61	2.18
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	8.48	91.52	8.18	0.30	0.00	1.82
<i>Potamogeton illinoensis</i>	Illinois pondweed	6.67	93.33	6.06	0.61	0.00	1.58
<i>Potamogeton gramineus</i>	Grassy pondweed	4.24	95.76	3.94	0.30	0.00	0.97
<i>Heteranthera dubia</i>	Water star grass	3.03	96.97	3.03	0.00	0.00	0.61
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	1.82	98.18	1.52	0.30	0.00	0.48
<i>Najas flexilis</i>	Slender naiad	1.52	98.48	1.52	0.00	0.00	0.30
<i>Myriophyllum exallescens</i>	Northern watermilfoil	1.21	98.79	1.21	0.00	0.00	0.24
<i>Potamogeton berchtoldii</i>	Small pondweed	1.21	98.79	1.21	0.00	0.00	0.24
<i>Potamogeton friesii</i>	Flat-stalked pondweed	0.91	99.09	0.91	0.00	0.00	0.18
<i>Elodea nuttallii</i>	Nuttall's water-weed	0.30	99.70	0.30	0.00	0.00	0.06

<i>Potamogeton foliosus</i>	Leafy pondweed	0.30	99.70	0.30	0.00	0.00	0.06
<i>Potamogeton nodosus</i>	Long-leaf pondweed	0.30	99.70	0.30	0.00	0.00	0.06
<i>Filamentous algae</i>	Filamentous algae	47.27					

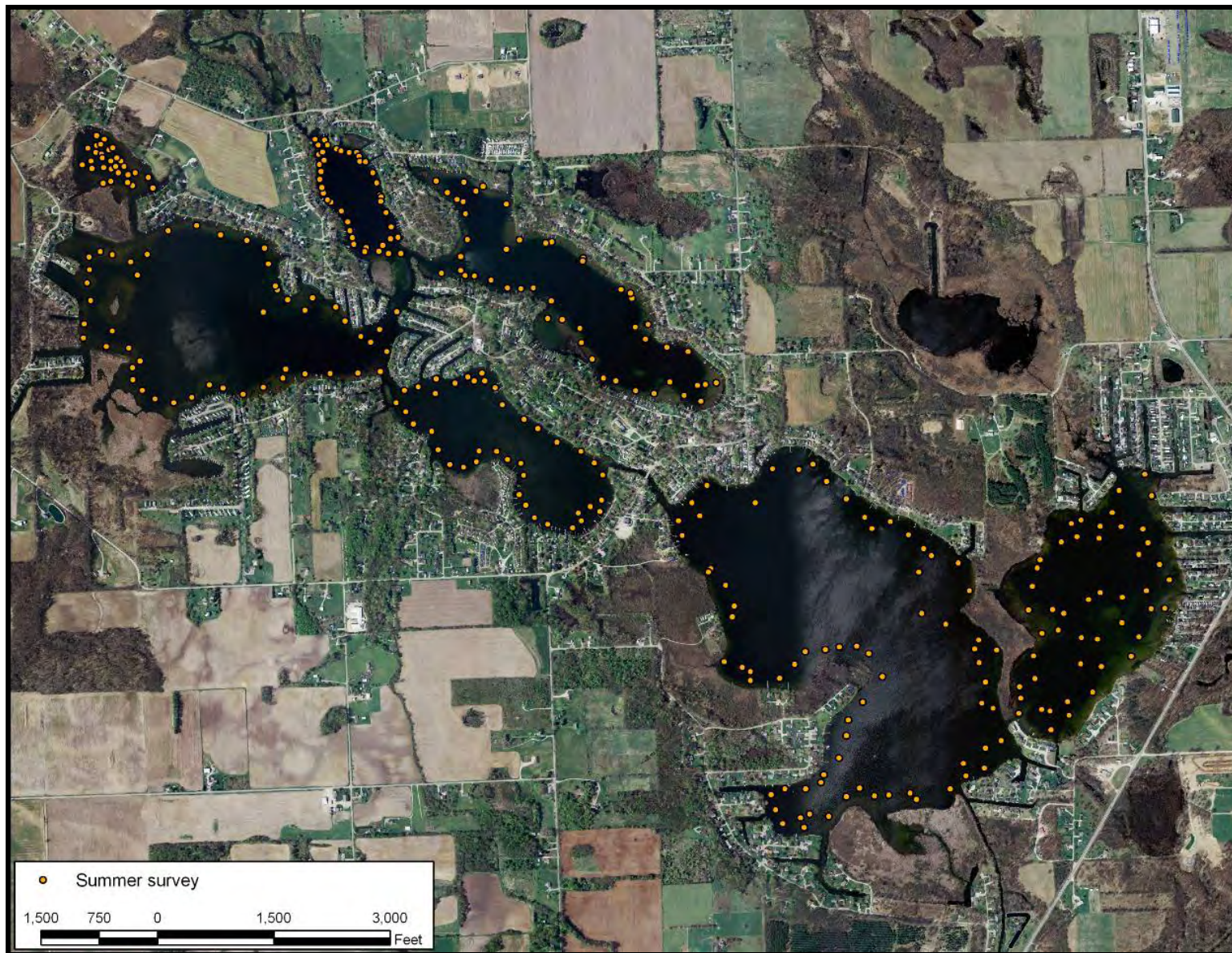


Figure 19. Sampling locations for the August 8 and 24, 2007 Tier II survey at the Barbee Lakes.

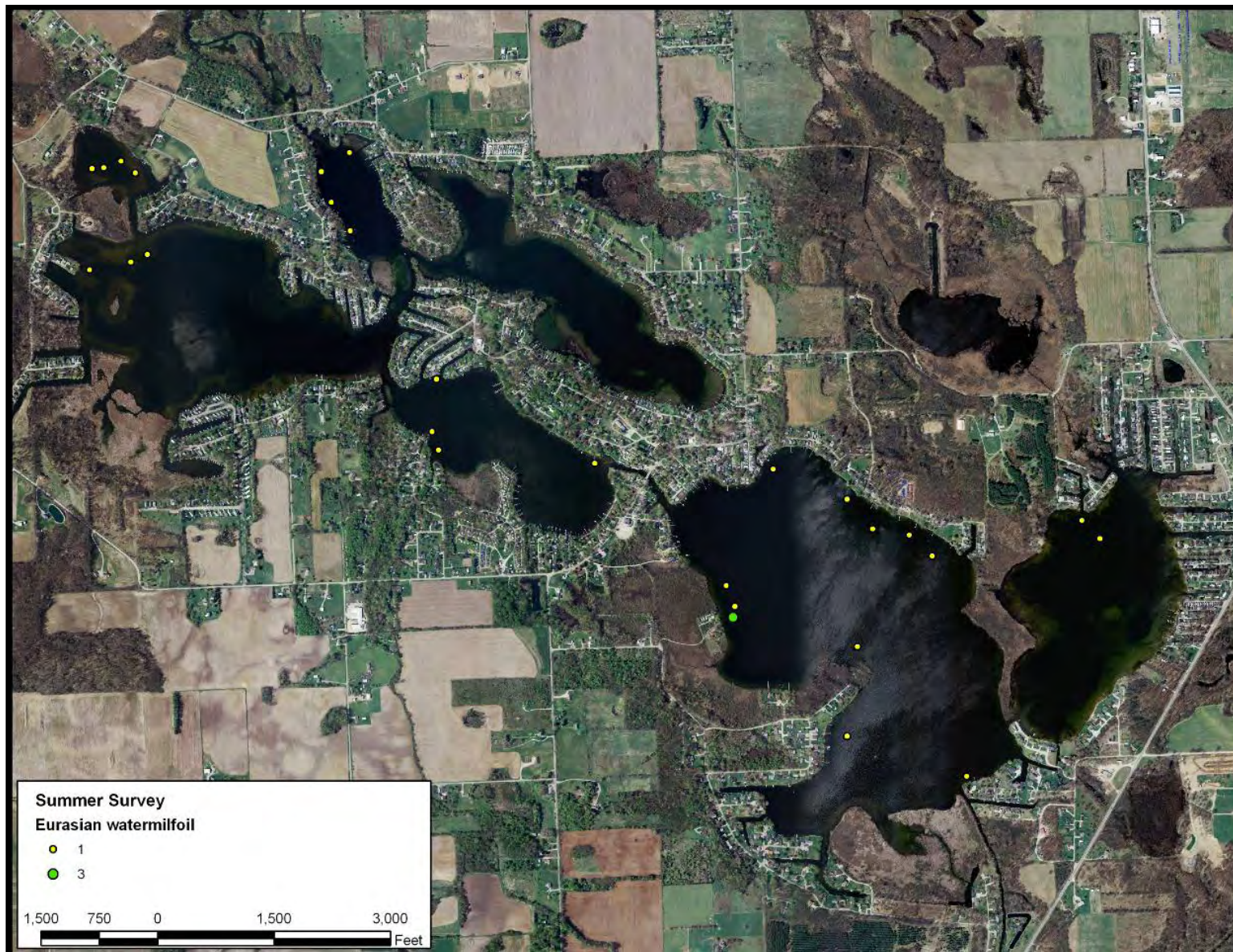


Figure 20. Barbee Lakes Eurasian watermilfoil locations and dominance as surveyed August 8 and 24, 2007.

Banning Lake

Transparency was measured at the deepest spot in the lake using a Secchi disk prior to both sampling events. Transparency was found to be 10.5 (3.2 m) feet during the spring and 6.2 feet (1.9 m) during the summer survey. Based on the survey protocol, plants were sampled to a depth of 15 feet. However, plants were only present to a maximum depth of 10 feet during the spring survey. During the summer survey, plants were present to a depth of 14 feet. Thirty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Appendix C, while Appendix D contains maps detailing the sampling points and resultant plant community present in Banning Lake.

Spring Survey

During the spring survey, chara, coontail, and Eurasian watermilfoil dominated the plant community over all depths (0-10 feet). These species were found at the highest percentage of sites throughout the entire sampled water column (24%). Chara maintained the highest relative density (0.9) and dominance (17.6). Eurasian watermilfoil had a dominance of 13.6, while coontail had a dominance of 9.6. Throughout the entire sampled water column, nitella, curly-leaf pondweed, sago pondweed, northern watermilfoil, and common bladderwort were relatively dense and were found at 8 to 12% of the sites (Table 15).

Chara dominated the shallowest stratum (0-5 foot) and was identified at 100% of sites in this stratum (Appendix C). Chara also possessed the highest dominance (100) and was more than four times as dominant as other species in this stratum. Eurasian watermilfoil, sago pondweed, and coontail were also prevalent in the 0-5 foot stratum and were present at 40% of the sample sites. Eurasian watermilfoil was present in this highest dominance (24), while sago pondweed and coontail were present in lower dominance (16). Common bladderwort was the only other species identified in the shallowest stratum.

In the 5-10 foot stratum, Eurasian watermilfoil, coontail, and common bladderwort all increased in frequency, while chara and sago pondweed decreased in frequency with increasing depth. Eurasian watermilfoil was the most frequently identified species and was present at 80% of sites. Chara and coontail were present at 60% of the sites, while northern watermilfoil, curly-leaf pondweed, and common bladderwort were present at 30% of the sites. Eurasian watermilfoil was also the most dominant species in the 5-10 foot stratum and occurred at more than twice the frequency (52 compared to 24) at which this species was observed in the 0-5 foot stratum. Chara (36), coontail (32), and nitella (20) maintained their dominance in the 5-10 foot stratum. Nitella, northern watermilfoil, curly-leaf pondweed, eel grass, and various-leaf watermilfoil were not present in the 0-5 foot stratum and were present in relatively low frequency in the 5-10 foot stratum. Northern watermilfoil was the most frequent (40%) of the plants identified only in the 5-10 foot stratum; however, nitella was the most dominant (20). Two exotic species, Eurasian watermilfoil and curly-leaf pondweed, were present in throughout the water column. Eurasian watermilfoil was present at 40% of the sites in the 0-5 foot stratum and 80% of the sites in the 5-10 foot stratum. Dominance of Eurasian watermilfoil also increased from the 0-5 foot to the 5-10 foot stratum measuring 24 and 52, respectfully. Eurasian watermilfoil was the second most prevalent species in the 0-5 foot stratum and the most dominant species in the 5-10 foot stratum. Curly-leaf pondweed was absent from the 0-5 foot stratum and occurred at 30% of the sites in the 5-10 foot stratum, respectfully. Figures 16-18 document sampling locations (Figure 16) and sites where Eurasian watermilfoil (Figure 17) and curly-leaf pondweed (Figure 18) were identified during the spring survey.

Table 15. Banning Lake spring Tier II survey metrics and results as collected June 6, 2007.

Occurrence and abundance of submersed aquatic plants in Banning Lake.							
Total Sites:	50	Mean species / site:	2.03	Native diversity:	0.81		
Littoral Sites:	47	Maximum species / site:	6	Species diversity:	0.85		
Littoral Depth (ft):	10	Number of species:	10	SE Mean natives / site:	0.27		
Date:	6/6/07	Littoral sites with plants:	21	Mean natives / site:	1.47		
Lake:	Banning	Secchi(ft):	10.5	SE Mean species / site:	0.33		
All depths (0-10')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Chara</i> species	Chara species	24.00	76.00	8.00	0.00	16.00	17.60
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	24.00	76.00	12.00	2.00	10.00	13.60
<i>Ceratophyllum demersum</i>	Coontail	24.00	76.00	16.00	4.00	4.00	9.60
<i>Nitella</i> species	Nitella species	12.00	88.00	8.00	0.00	4.00	5.60
<i>Stuckenia pectinatus</i>	Sago pondweed	8.00	92.00	6.00	2.00	0.00	2.40
<i>Myriophyllum exallescens</i>	Northern watermilfoil	8.00	92.00	6.00	2.00	0.00	2.40
<i>Potamogeton crispus</i>	Curly-leaf pondweed	10.00	90.00	10.00	0.00	0.00	2.00
<i>Utricularia vulgaris</i>	Common bladderwort	8.00	92.00	8.00	0.00	0.00	1.60
<i>Vallisneria americana</i>	Eel grass	2.00	98.00	2.00	0.00	0.00	0.40
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	2.00	98.00	2.00	0.00	0.00	0.40
Filamentous algae	Filamentous algae	20.00					

Summer Survey

During the summer survey, JFNew biologists observed that chara and coontail were still the most abundant species in Banning Lake (Table 16). Coontail was found at the highest percentage of sites throughout the entire sampled water column (34.5%); however, chara expressed the highest dominance (20). Chara dominated the shallowest stratum (0-5 foot) and was identified at 56% of sites in this stratum. Chara also possessed the highest dominance (36.3) in this stratum. Chara was absent from the 5-10 foot and 10-15 foot strata. Coontail possessed the second highest frequency in the 0-5 foot stratum and was present at 50% of the sites with a dominance of 25. Common bladderwort was also relatively frequent being present at 25% of the sites; however, bladderwort was present in limited frequency expressing a dominance of 7.5. All other species observed in this shallow stratum were present in relatively low frequency and dominance. Only three species present in the 0-5 foot stratum were also present in the 5-10 foot stratum. These included coontail, nitella, and Eurasian watermilfoil, which decreased in frequency and dominance with increasing depth. Coontail was present at 22% of the sites in the 5-10 foot stratum, while Eurasian watermilfoil and nitella were present at 11% of the sites. All species identified in this stratum were present in relatively low frequency.

Table 16. Banning Lake summer Tier II survey metrics and results as collected August 24, 2007.

Occurrence and abundance of submersed aquatic plants in Banning Lake.					
Total Sites:	29	Mean species / site:	1.14	Native diversity:	0.76
Littoral Sites:	25	Maximum species / site:	5	Species diversity:	0.80
Littoral Depth (ft):	10	Number of species:	7	SE Mean natives / site:	0.25
Date:	8/24/07	Littoral sites with plants:	15	Mean natives / site:	1.03
Lake:	Banning	Secchi(ft):	6.2	SE Mean species / site:	0.27

All depths (0-15')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Chara species</i>	Chara species	31.03	68.97	6.90	13.79	10.34	20.00
<i>Ceratophyllum demersum</i>	Coontail	34.48	65.52	13.79	17.24	3.45	16.55
<i>Utricularia vulgaris</i>	Common bladderwort	13.79	86.21	10.34	3.45	0.00	4.14
<i>Nitella species</i>	Nitella species	10.34	89.66	6.90	3.45	0.00	3.45
<i>Stuckenia pectinatus</i>	Sago pondweed	6.90	93.10	3.45	3.45	0.00	2.76
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	10.34	89.66	10.34	0.00	0.00	2.07
<i>Najas guadalupensis</i>	Southern naiad	6.90	93.10	6.90	0.00	0.00	1.38
<i>Filamentous algae</i>	Filamentous algae	34.48					

Overall, chara and coontail increased in frequency from the spring survey to the summer survey measuring increases of 24% to 31% and 34%, respectively. Increases in dominance were also recorded for these two species from the spring to the summer surveys (Tables 15 and 16). All other species decreased in frequency from the spring survey to the summer survey. Additionally, two exotic species, Eurasian watermilfoil and curly-leaf pondweed, were identified during the spring survey; however, only Eurasian watermilfoil was present during the summer survey of Banning Lake. This species decreased in both dominance and frequency from the spring to the summer. Eurasian watermilfoil was present at 24% of the sites during the spring with a dominance of 13.6. During the summer survey, Eurasian watermilfoil was present at 10% of the sites with a dominance of 2.1. Figures 17 and 20 indicate locations where Eurasian watermilfoil were recorded during the spring and summer surveys, respectively.

Big Barbee Lake

Transparency was measured at the deepest spot in the lake using a Secchi disk prior to both sampling events. Transparency was not recorded during the spring survey due to unfavorable weather conditions. Transparency was found to be 4.5 feet (1.4 m) during the summer survey. Based on the survey protocol, plants were sampled to a depth of 20 feet. However, plants were present to a maximum depth of 17 feet during the spring survey and to a depth of 15 feet during the summer survey. Seventy sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Appendix C.

Spring Survey

During the spring survey, coontail dominated the aquatic plant community throughout the entire sampled water column (0-20 feet; Table 17). This species was found at 85% of the sites and was present at more than double the dominance of any other species observed in Big Barbee Lake during the spring survey (61.2 compared to 28.2). Coontail was the most dominant species in every strata of the water column and was present at its highest dominance and frequency in the 5-10 foot stratum. Coontail occurred at 75% of the sites in the 0-5 foot stratum, increased in frequency to 95% of the sites in the 5-10 foot stratum, and then decreased slightly to 92% of the sites in the 10-15 foot stratum (Appendix C).

Table 17. Big Barbee Lake spring Tier II survey metrics and results as collected June 7, 2007.

Occurrence and abundance of submersed aquatic plants in Big Barbee Lake.							
Total Sites:	68	Mean species / site:	2.97	Native diversity:	0.78		
Littoral Sites:	67	Maximum species / site:	8	Species diversity:	0.84		
Littoral Depth (ft):	17	Number of species:	13	SE Mean natives / site:	0.15		
Date:	6/7/07	Littoral sites with plants:	67	Mean natives / site:	2.18		
Lake:	Big Barbee	Secchi(ft):	N/A	SE Mean species / site:	0.20		
All depths (0-20')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	85.29	14.71	17.65	25.00	42.65	61.18
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	50.00	50.00	20.59	13.24	16.18	28.24
<i>Elodea canadensis</i>	Common water weed	36.76	63.24	16.18	10.29	10.29	19.71
<i>Chara</i> species	Chara species	32.35	67.65	20.59	7.35	4.41	12.94
<i>Potamogeton crispus</i>	Curly-leaf pondweed	29.41	70.59	25.00	2.94	1.47	8.24
<i>Najas guadalupensis</i>	Southern naiad	19.12	80.88	17.65	1.47	0.00	4.41
<i>Stuckenia pectinatus</i>	Sago pondweed	10.29	89.71	8.82	0.00	1.47	3.24
<i>Vallisneria americana</i>	Eel grass	13.24	86.76	11.76	1.47	0.00	3.24
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	5.88	94.12	5.88	0.00	0.00	1.18
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	5.88	94.12	5.88	0.00	0.00	1.18
<i>Myriophyllum exalbescent</i>	Northern watermilfoil	5.88	94.12	5.88	0.00	0.00	1.18
<i>Utricularia vulgaris</i>	Common bladderwort	1.47	98.53	0.00	1.47	0.00	0.88
<i>Elodea nuttallii</i>	Nuttall's water-weed	1.47	98.53	1.47	0.00	0.00	0.29
<i>Filamentous algae</i>	Filamentous algae	80.88					

Eurasian watermilfoil, common waterweed, chara, and curly-leaf pondweed were also relatively prevalent within Big Barbee Lake during the spring. Eurasian watermilfoil was identified at 50% of the sites and maintained a dominance of 28.2. Eurasian watermilfoil's frequency was the highest in the shallowest stratum and decreased with increasing depth. This species was present at 60% of the sites in the 0-5 foot stratum, 59% of the sites in the 5-10 foot stratum, and only 8.3% of the sites in the 10-15 foot stratum. However, the dominance of Eurasian watermilfoil increased from the 0-5 foot stratum to the 5-10 foot stratum before declining again in the 10-15 foot stratum; dominance ratings were 30.3, 37.3, and 8.3, respectively. Common waterweed, chara, and curly-leaf pondweed followed similar patterns. Common waterweed was present at 42% of the sites in the 0-5 foot stratum but increased in frequency in the 5-10 foot stratum and was present at 50% of the sites. However, the dominance of common waterweed decreased with increasing depth (30.3 compared to 19.1). Chara was present at 36% of the sites in the 0-5 foot stratum, but declined to 18% of the sites in the 5-10 foot stratum, and was absent from the 10-15 foot stratum. Curly-leaf pondweed was similarly frequent in the upper stratum and was present at 36% of the sites in the 0-5 foot stratum. Curly-leaf pondweed decreased in frequency and dominance with increasing depth and was present at 31% of the sites in the 5-10 foot stratum and 8.3% of the sites in the 10-15 foot stratum. Eight other aquatic species were observed in Big Barbee Lake during the spring survey; however, these species were relatively sparse and infrequent compared with those previously discussed. Two exotic species, curly-leaf pondweed and Eurasian watermilfoil, were identified within Big Barbee Lake during the spring Tier II survey. Figures 16-18 document sampling locations (Figure 16) and sites where Eurasian watermilfoil (Figure 17) and curly-leaf pondweed (Figure 18) were identified during the spring survey.

Summer Survey

Coontail was again the most prevalent species identified in Big Barbee Lake during the summer survey (Table 18). Coontail was identified at 85% of the sites with a dominance of 58.6. Coontail was more than five times more frequent and more than eight times more dominant than the next most prevalent species. Coontail was found at its highest frequency in the shallowest stratum. This species was found at 90% of the sites in the 0-5 foot stratum, 87% of the sites in the 5-10 foot stratum, and at 63% of the sites in the 10-15 foot stratum. Coontail was most dominant in the 5-10 foot stratum where a dominance of 74.8 was calculated. Overall, coontail dominated the aquatic plant community at all sampled strata during the summer aquatic plant survey of Big Barbee Lake. However, common waterweed, southern naiad, and eel grass were relatively frequent in Big Barbee Lake during the summer survey. These species were identified at 15%, 14%, and 11% of the sites, respectively. However, they were present in relatively low dominance (calculated dominance of 7.4, 3.3, and 2.7, respectively). Common waterweed, southern naiad, and eel grass were also relatively common in the 0-5 foot stratum. However, their frequency and dominance decreased with increasing depth. Common waterweed was present at 18% of the sites in the 0-5 foot stratum, but was absent from the 5-10 foot and 10-15 foot strata. Southern naiad was present at 18% of the sites in the 0-5 foot stratum, but was present at only 8.7% of the sites in the 5-10 foot stratum, and at 9.1% of the sites in the 10-15 foot stratum, while eel grass was present at 18% of the sites in the 0-5 foot stratum, but was present at 8.7% of the sites in the 5-10 foot stratum and only 4.4% of the sites in the 10-15 foot stratum. Only Eurasian watermilfoil increased in frequency and dominance with increasing depth. Eurasian watermilfoil was present at 2.6% of the sites in the 0-5 foot stratum (dominance of 0.5) and increased to be present at 8.7% of the sites in the 5-10 foot stratum (dominance of 1.7).

Table 18. Big Barbee Lake summer Tier II survey metrics and results as collected August 8, 2007.

Occurrence and abundance of submersed aquatic plants in Big Barbee Lake.							
Total Sites:	73	Mean species / site:	1.47	Native diversity:		0.61	
Littoral Sites:	67	Maximum species / site:	5	Species diversity:		0.63	
Littoral Depth (ft):	15	Number of species:	11	SE Mean natives / site:		0.12	
Date:	8/8/07	Littoral sites with plants:	67	Mean natives / site:		1.42	
Lake:	Big Barbee	Secchi(ft):	4.5	SE Mean species / site:		0.13	
All depths (0-15')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	84.93	15.07	24.66	16.44	43.84	58.63
<i>Elodea canadensis</i>	Common water weed	15.07	84.93	6.85	5.48	2.74	7.40
<i>Najas guadalupensis</i>	Southern naiad	13.70	86.30	12.33	1.37	0.00	3.29
<i>Vallisneria americana</i>	Eel grass	10.96	89.04	9.59	1.37	0.00	2.74
<i>Stuckenia pectinatus</i>	Sago pondweed	8.22	91.78	8.22	0.00	0.00	1.64
<i>Chara</i> species	Chara species	2.74	97.26	1.37	1.37	0.00	1.10
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	4.11	95.89	4.11	0.00	0.00	0.82
<i>Utricularia vulgaris</i>	Common bladderwort	2.74	97.26	2.74	0.00	0.00	0.55
<i>Potamogeton illinoensis</i>	Illinois pondweed	1.37	98.63	1.37	0.00	0.00	0.27
<i>Potamogeton friesii</i>	Flat-stalked pondweed	1.37	98.63	1.37	0.00	0.00	0.27
<i>Elodea nuttallii</i>	Nuttall's water-weed	1.37	98.63	1.37	0.00	0.00	0.27
<i>Filamentous algae</i>	Filamentous algae	63.01					

Overall, coontail maintained its frequency (85% of sites) and dominance (58-61) from the spring to the summer survey. All other species declined in both frequency and dominance. Most notable are changes in the Eurasian watermilfoil and chara populations. Chara, which occurred at 32% of the sites during the summer survey, was found at only 2.7% of the sites during the spring survey. Eurasian watermilfoil was present at 50% of the sites during the spring survey but was identified at only 4.1% of the sites during the summer survey. Both species decreased in dominance as well with dominances of 12.9 and 1.1 calculated for chara during the spring and summer, respectively and 28.2 and 0.8 for Eurasian watermilfoil during the spring and summer, respectively. Figures 17 and 20 indicate locations where Eurasian watermilfoil were recorded during the spring and summer surveys, respectively.

Irish Lake

Transparency was measured at the deepest spot in the lake using a Secchi disk prior to both sampling events. Transparency was found to be 11.5 (3.5 m) feet during the spring and 11.0 feet (3.4 m) during the summer survey. Based on the survey protocol, plants were sampled to a depth of 10 feet. Aquatic plants were identified to a depth of 10 feet during both the spring and summer surveys. Fifty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Appendix C.

Spring Survey

Chara, coontail, Eurasian watermilfoil, and eel grass dominated the aquatic plant community within Irish Lake throughout the entire sampled water column (0-10 feet). All four species were relatively equally frequent being identified at 44% to 52% of the sites (Table 19). Chara and coontail were the most dominant score 26.4 and 26.0, respectively, while Eurasian watermilfoil possessed a dominance of 21.2 and eel grass a dominance of 13.6. Sago pondweed, northern watermilfoil, curly-leaf pondweed and southern naiad were also relatively frequent within Irish Lake during the spring survey. Chara was the most frequent and most dominant species in the shallowest stratum. This species was identified at 65% of the sites and rated a dominance of 32, which was double that recorded for all other species in Irish Lake during the spring survey. Eel grass, coontail, sago pondweed, and Eurasian watermilfoil were relatively frequent in the 0-5 foot stratum occurring at 48%, 42%, 38%, and 35% of the sites, respectively. Despite their relatively high frequency, these species were relatively non-dominant in the 0-5 foot stratum. Coontail, Eurasian watermilfoil, northern watermilfoil, and curly-leaf pondweed all increased in frequency and dominance with increasing depth. Coontail, which occurred at 42% of the sites in the 0-5 foot stratum, was present at 74% of the sites in the 5-10 foot stratum. Furthermore, coontail, which rated a dominance of 16.1 in the 0-5 foot stratum, increased nearly fourfold to record a dominance of 42.1 in the 5-10 foot stratum. Eurasian watermilfoil displayed a similar pattern occurring at 35% of the sites in the 0-5 foot stratum and 63% of the sites in the 5-10 foot stratum with dominances of 13.5 and 33.7, respectively. Curly-leaf pondweed also followed this pattern doubling in both frequency and dominance from the 0-5 foot to the 5-10 foot strata. Figures 16-18 document sampling locations (Figure 16) and sites where Eurasian watermilfoil (Figure 17) and curly-leaf pondweed (Figure 18) were identified during the spring survey.

Table 19. Irish Lake spring Tier II survey metrics and results as collected June 6, 2007.

Occurrence and abundance of submersed aquatic plants in Irish Lake.							
Total Sites:	50	Mean species / site:	2.94	Native diversity:	0.84		
Littoral Sites:	47	Maximum species / site:	8	Species diversity:	0.87		
Littoral Depth (ft):	10	Number of species:	14	SE Mean natives / site:	0.19		
Date:	6/6/07	Littoral sites with plants:	47	Mean natives / site:	2.34		
Lake:	Irish	Secchi(ft):	11.5	SE Mean species / site:	0.23		
All depths (0-10')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Chara</i> species	Chara species	52.00	48.00	22.00	20.00	10.00	26.40
<i>Ceratophyllum demersum</i>	Coontail	54.00	46.00	26.00	18.00	10.00	26.00
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	46.00	54.00	26.00	10.00	10.00	21.20
<i>Vallisneria americana</i>	Eel grass	44.00	56.00	32.00	12.00	0.00	13.60
<i>Stuckenia pectinatus</i>	Sago pondweed	32.00	68.00	22.00	10.00	0.00	10.40
<i>Myriophyllum exallescens</i>	Northern watermilfoil	12.00	88.00	6.00	6.00	0.00	4.80
<i>Potamogeton crispus</i>	Curly-leaf pondweed	14.00	86.00	14.00	0.00	0.00	2.80
<i>Najas guadalupensis</i>	Southern naiad	12.00	88.00	12.00	0.00	0.00	2.40
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	6.00	94.00	4.00	2.00	0.00	2.00
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	8.00	92.00	8.00	0.00	0.00	1.60
<i>Elodea canadensis</i>	Common water weed	6.00	94.00	6.00	0.00	0.00	1.20
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	4.00	96.00	4.00	0.00	0.00	0.80
<i>Potamogeton natans</i>	Floating-leaf pondweed	2.00	98.00	2.00	0.00	0.00	0.40
<i>Potamogeton illinoensis</i>	Illinois pondweed	2.00	98.00	2.00	0.00	0.00	0.40
<i>Filamentous algae</i>	Filamentous algae	52.00					

Summer Survey

During the summer survey, JFNew biologists observed that coontail was still the most abundant species in Irish Lake (Table 20). Coontail was found at the highest percentage of sites throughout the entire sampled water column (60%) and also had the highest dominance (30.4). Chara and eel grass were nearly equally frequent throughout the water column occurring at 56% and 58% of the sites, respectively. These species were also relatively dominant rating 30.4 and 25.8 throughout the water column, respectively. Sago pondweed, southern naiad, and Eurasian watermilfoil occurred at a relatively high frequency of the sites (10.4% to 37.5%) but occurred in relatively low dominance (2.9 to 15.0). Chara and eel grass were co-dominant within the shallowest strata. Eel grass occurred at the highest frequency of sites in the 0-5 foot stratum and was the second most dominant species, while chara was the second most frequent species and was the most dominant species overall. Chara occurred at 64% of the sites and rated a dominance of 36.1, while eel grass occurred at 72% of the sites with a dominance of 31.1. Coontail, which was also relatively frequent and dominant, occurred at 47% of the sites with a dominance of 21.7 in the 0-5 foot stratum. All other species, including Eurasian watermilfoil, occurred at less than 20% of the sites with Eurasian watermilfoil occurring at 14% of the sites with a dominance of 2.8. Coontail's frequency and dominance increased with increasing depth. Coontail was found at 100% of the sites with a dominance of 56.7 and was nearly five times as dominant as other species in the 5-10 foot stratum. Conversely, chara and eel grass decreased in both frequency and dominance with increasing depth. Chara was found at 33% of sites in the 5-10 foot stratum as compared to 64% of sites in the 0-5 foot stratum, while eel grass was found at only 16% of the sites in the 5-10 foot stratum as compared to being found at 72% of the sites in the 0-5 foot stratum. Sago pondweed, southern naiad, slender naiad, northern watermilfoil,

and water star grass all remained at similar frequencies or increased nominally with increasing depth. Eurasian watermilfoil and Illinois pondweed were not present in the 5-10 foot stratum. Figures 19-20 document sampling locations (Figure 19) and sites where Eurasian watermilfoil (Figure 20) was identified during the summer survey, while Appendix C contains full results for sampling in Irish Lake.

Table 20. Irish Lake summer Tier II survey metrics and results as collected August 8, 2007.

Occurrence and abundance of submersed aquatic plants in Irish Lake.							
Total Sites:	48	Mean species / site:	2.77	Native diversity:	0.83		
Littoral Sites:	48	Maximum species / site:	6	Species diversity:	0.84		
Littoral Depth (ft):	11	Number of species:	16	SE Mean natives / site:	0.19		
Date:	8/8/07	Littoral sites with plants:	48	Mean natives / site:	2.67		
Lake:	Irish	Secchi(ft):	11.0	SE Mean species / site:	0.20		
All depths (0-10')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Chara</i> species	Chara species	56.25	43.75	22.92	18.75	14.58	30.42
<i>Ceratophyllum demersum</i>	Coontail	60.42	39.58	27.08	20.83	12.50	30.42
<i>Vallisneria americana</i>	Eel grass	58.33	41.67	35.42	10.42	12.50	25.83
<i>Stuckenia pectinatus</i>	Sago pondweed	37.50	62.50	20.83	14.58	2.08	15.00
<i>Najas guadalupensis</i>	Southern naiad	18.75	81.25	16.67	2.08	0.00	4.58
<i>Potamogeton illinoensis</i>	Illinois pondweed	6.25	93.75	2.08	4.17	0.00	2.92
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	10.42	89.58	10.42	0.00	0.00	2.08
<i>Heteranthera dubia</i>	Water star grass	6.25	93.75	6.25	0.00	0.00	1.25
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	4.17	95.83	4.17	0.00	0.00	0.83
<i>Najas flexilis</i>	Slender naiad	4.17	95.83	4.17	0.00	0.00	0.83
<i>Myriophyllum exalbescens</i>	Northern water milfoil	4.17	95.83	4.17	0.00	0.00	0.83
<i>Potamogeton friesii</i>	Flat-stalked pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Elodea canadensis</i>	Common water weed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Utricularia vulgaris</i>	Common bladderwort	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton gramineus</i>	Grassy pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Filamentous algae</i>	Filamentous algae	41.67					

Kuhn Lake

Transparency was measured at the deepest spot in the lake using a Secchi disk prior to both sampling events. Transparency was found to be 9.5 (2.9 m) feet during the spring and 11.5 feet (3.5 m) during the summer survey. Based on the survey protocol, plants were sampled to a depth of 20 feet. However, plants were only present to a maximum depth of 15 feet during the spring survey. During the summer survey, plants were present to a depth of 18 feet. Fifty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Appendix C.

Spring Survey

During the spring survey, 17 submerged species were identified within Kuhn Lake (Table 21). (Figure 16 documents the sampling locations for the spring survey of Kuhn Lake.) Of these, various-leaf watermilfoil dominated the plant community throughout the entire sampled water column (0-15 feet). This species was found at the highest percentage of the sites throughout the

entire sampled water column (68%) and also had the highest dominance (44.8) and relative density (2.24). Throughout the entire sampled water column, curly-leaf pondweed, eel grass, Illinois pondweed, chara, and white-stem pondweed were relatively dense and were found at 42%, 36%, 34%, 30%, and 22% of the sites, respectively (Appendix C). In total, seven pondweed species were identified during the Tier II survey of Kuhn Lake. Various-leaf watermilfoil dominated the shallowest stratum (0-5 foot) and was identified at 78% of the sites in this stratum. Various-leaf watermilfoil also possessed the highest dominance (53.9) and was more than twice as dominant as other species in this stratum. Chara was also prevalent in the 0-5 foot stratum and was present at 52% of the sampled sites. Eel grass and Illinois pondweed were present at approximately 47% of the sites in the 0-5 foot stratum, but were present in relatively low dominance (9.6). White-stem pondweed and curly-leaf pondweed were also relatively common and were identified at 22% and 17% of the sites, respectively. However, they were present in relatively low dominances (6.1 and 8.7, respectively). All other species identified in the 0-5 foot stratum were present in relatively low frequency (<15%) and with relatively low dominance (<6.1).

Table 21. Kuhn Lake spring Tier II survey metrics and results as collected June 7, 2007.

Occurrence and abundance of submersed aquatic plant species in Kuhn Lake.							
Total Sites:	50	Mean species / site:	3.08	Native diversity:		0.87	
Littoral Sites:	47	Maximum species / site:	6	Species diversity:		0.88	
Littoral Depth (ft):	15	Number of species:	16	SE Mean natives / site:		0.19	
Date:	6/7/07	Littoral sites with plants:	47	Mean natives / site:		2.62	
Lake:	Kuhn	Secchi(ft):	9.5	SE Mean species / site:		0.23	
All depths (0-15')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	68.00	32.00	22.00	14.00	32.00	44.80
<i>Potamogeton crispus</i>	Curly-leaf pondweed	42.00	58.00	30.00	10.00	2.00	14.00
<i>Potamogeton praelongus</i>	White-stemmed pondweed	22.00	78.00	4.00	12.00	6.00	14.00
<i>Chara</i> species	Chara species	30.00	70.00	18.00	8.00	4.00	12.40
<i>Potamogeton illinoensis</i>	Illinois pondweed	34.00	66.00	30.00	2.00	2.00	9.20
<i>Vallisneria americana</i>	Eel grass	36.00	64.00	34.00	2.00	0.00	8.00
<i>Nitella</i> species	Nitella species	16.00	84.00	12.00	0.00	4.00	6.40
<i>Elodea canadensis</i>	Common water weed	8.00	92.00	4.00	2.00	2.00	4.00
<i>Potamogeton gramineus</i>	Grassy pondweed	14.00	86.00	14.00	0.00	0.00	2.80
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	4.00	96.00	2.00	0.00	2.00	2.40
<i>Potamogeton friesii</i>	Flat-stalked pondweed	2.00	98.00	0.00	0.00	2.00	2.00
<i>Utricularia vulgaris</i>	Common bladderwort	10.00	90.00	10.00	0.00	0.00	2.00
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	8.00	92.00	8.00	0.00	0.00	1.60
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	6.00	94.00	6.00	0.00	0.00	1.20
<i>Najas guadalupensis</i>	Southern naiad	4.00	96.00	4.00	0.00	0.00	0.80
<i>Ceratophyllum demersum</i>	Coontail	4.00	96.00	4.00	0.00	0.00	0.80
<i>Filamentous algae</i>	Filamentous algae	6.00					

In deeper water, the aquatic plant community continued to change in variety. Initially, various-leaf watermilfoil maintained its high frequency and dominance; however, both frequency and dominance of this species decreased with increasing depth. Various-leaf watermilfoil was present at 87% of the sites with a dominance of 57.5 in the 5-10 foot stratum; however, this species was only present at only 18% of the sites with dominance less than 7.3 in the 10-15 foot stratum. Curly-leaf pondweed

was the most dominant species in the 5-10 foot stratum being present at 81% of the sites. Additionally, this species was the third most dominant (28.8) within this stratum. Like various-leaf watermilfoil, curly-leaf pondweed's frequency and dominance decreased with increasing depth and was present at 27% of the sites (dominance of 9.1) in the 10-15 foot stratum. Nitella, a species that prefers deep waters of clear lakes, was present at 63% of the sites in the 10-15 foot stratum with a dominance of 20. Only four other species were present within this stratum including eel grass, grassy pondweed, Illinois pondweed, and coontail. All of these species were present in relatively low frequencies and dominances.

Two exotic species were present in Kuhn Lake during the spring survey: curly-leaf pondweed and Eurasian watermilfoil. As previously discussed, curly-leaf pondweed was relatively frequent and relatively dense throughout the water column. Eurasian watermilfoil was present in relatively low dominance throughout the water column. Eurasian watermilfoil was present at 4.3% of the sites in the 0-5 foot stratum, 6.3% of the sites in the 5-10 foot stratum, and was absent from the 10-15 foot stratum. Curly-leaf pondweed dominance followed a similar pattern with the highest dominance occurring in the 5-10 foot stratum. Curly-leaf pondweed occurred at 21% of the sites with a dominance of 6.1 in the 0-5 foot stratum, then increased from the 0-5 foot to the 5-10 foot stratum occurring at 81% of the sites with a dominance measuring 28.8 before decreasing again in the 10-15 foot stratum. Figures 17 and 18 document sites where Eurasian watermilfoil (Figure 17) and curly-leaf pondweed (Figure 18) were identified during the spring survey. The locations and dominance of other species are documented in Appendix D.

Summer Survey

During the summer survey, JFNew biologists observed that various-leaf watermilfoil was again the most abundant species in Kuhn Lake (Table 22). (Figure 19 documents the sampling locations for the summer survey of Kuhn Lake.) Various-leaf watermilfoil was found at the highest percentage of the sites throughout the entire sampled water column (67%) and also had the highest dominance (29.2) and relative density (1.9). White-stem pondweed, nitella, eel grass, Illinois pondweed, chara, and southern naiad were also relatively prevalent throughout the water column. White-stem pondweed was present at 35% of the sites, while eel grass, Illinois pondweed, and nitella were present at 27% of the sites, chara was present at 25% of the sites, and southern naiad was present at 20% of the sites. Despite their frequency, none of these species were present in as high a dominance as various-leaf watermilfoil (Table 22). Overall, 21 submerged species were identified in Kuhn Lake during the summer Tier II survey.

Table 22. Kuhn Lake summer Tier II survey metrics and results as collected August 8, 2007.

Occurrence and abundance of submersed aquatic plants in Kuhn Lake.							
Total Sites:	48	Mean species / site:	3.02	Native diversity:		0.89	
Littoral Sites:	45	Maximum species / site:	6	Species diversity:		0.89	
Littoral Depth (ft):	18	Number of species:	19	SE Mean natives / site:		0.22	
Date:	8/8/07	Littoral sites with plants:	45	Mean natives / site:		3.00	
Lake:	Kuhn	Secchi(ft):	11.5	SE Mean species / site:		0.22	
All depths (0-20')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	66.67	33.33	22.92	22.92	20.83	39.17
<i>Potamogeton praelongus</i>	White-stemmed pondweed	35.42	64.58	16.67	14.58	4.17	16.25
<i>Chara</i> species	Chara species	25.00	75.00	4.17	16.67	4.17	15.00

<i>Nitella</i> species	Nitella species	27.08	72.92	16.67	0.00	10.42	13.75
<i>Vallisneria americana</i>	Eel grass	27.08	72.92	22.92	4.17	0.00	7.08
<i>Potamogeton illinoensis</i>	Illinois pondweed	27.08	72.92	27.08	0.00	0.00	5.42
<i>Najas guadalupensis</i>	Southern naiad	20.83	79.17	18.75	2.08	0.00	5.00
<i>Stuckenia pectinatus</i>	Sago pondweed	18.75	81.25	16.67	2.08	0.00	4.58
<i>Potamogeton gramineus</i>	Grassy pondweed	16.67	83.33	14.58	2.08	0.00	4.17
<i>Utricularia vulgaris</i>	Common bladderwort	10.42	89.58	8.33	2.08	0.00	2.92
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	8.33	91.67	6.25	2.08	0.00	2.50
<i>Ceratophyllum demersum</i>	Coontail	4.17	95.83	4.17	0.00	0.00	0.83
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton berchtoldii</i>	Small pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Myriophyllum exalbescens</i>	Northern water milfoil	2.08	97.92	2.08	0.00	0.00	0.42
<i>Elodea canadensis</i>	Common water weed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton nodosus</i>	Long-leaf pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton friesii</i>	Flat-stalked pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton foliosus</i>	Leafy pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Filamentous algae</i>	Filamentous algae	14.58					

Various-leaf watermilfoil also dominated the shallowest stratum (0-5 foot) and was identified at 75% of the sites in this stratum. Various-leaf watermilfoil also possessed the highest dominance (42.5). Various-leaf watermilfoil's frequency and dominance increased in the 5-10 foot stratum and was identified at 100% of the sites with a dominance of 62.7. The frequency and dominance of various-leaf watermilfoil decreased with increasing depth. This species was present at 44% and 12.5% of the sites, respectively with a dominance of 26.7 and 2.5, respectively.

Chara, southern naiad, Illinois pondweed, sago pondweed, and eel grass were relatively frequent within the 0-5 foot stratum of Kuhn Lake. Chara was present at 62.5% of the sites and was more dense (35.0) than many of the other frequent species in this stratum. Southern naiad, sago pondweed, and Illinois pondweed were present at 37.5% of the sites but in relatively low dominances; the dominance score for these species was 10.0 or less. Likewise, eel grass was present at 32.5% of the sites, but in relatively low dominance with a dominance of 8.75. Chara's frequency and dominance decreased with increasing depth and was present at only 13% of the sites in the 5-10 foot stratum. Chara was not found in the 10-15 foot or 15-20 foot strata, as would be expected for this species. However, white-stem pondweed, Illinois pondweed, and eel grass maintained their relatively high frequency in the 5-10 foot stratum. White-stem and Illinois pondweed were each present at 47% of the sites, while eel grass was present at 40% of the sites. With the exception of white-stem pondweed, the frequencies and dominances of these species declined with increasing depth. Additionally, nitella's frequency and dominance increased in the deeper strata. This species was present at 55% of the sites in the 10-15 foot stratum and 75% of the sites in the 15-20 foot stratum.

Only one exotic species, Eurasian watermilfoil, was present in Kuhn Lake during the summer survey. Eurasian watermilfoil was present in relatively low dominance throughout the water column. Eurasian watermilfoil was observed in the 5-10 foot stratum only. Eurasian watermilfoil was present at 6.7% of the sites within this stratum with a dominance of 1.3. Sites where Eurasian watermilfoil was identified during the summer survey are detail in Figure 20. The locations and dominance of other species are documented in Appendix D.

Little Barbee Lake

Transparency was measured at the deepest spot in the lake using a Secchi disk prior to both sampling events. Transparency was found to be 6.5 (2.0 m) feet during the spring and 6.5 feet (2.0 m) during the summer survey. Based on the survey protocol, plants were sampled to a depth of 15 feet. Plants were present to a maximum depth of 14 feet during both the spring and summer surveys. Forty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Appendix C.

Spring Survey

During the spring survey, coontail dominated the plant community over all sampled depths (0-15 feet; Table 23). Coontail was found at 85% of the sites throughout the lake and was present in nearly double the dominance (67.8) of other species identified within Little Barbee Lake. Eurasian watermilfoil, common waterweed, sago pondweed, and chara were also present in relatively high frequency. Eurasian watermilfoil occurred at 56% of the sites, while common waterweed was present at 29% of the sites, and sago pondweed and chara were identified at 15% of the sites. All of these species were present in relatively low dominance when compared to coontail. Eurasian watermilfoil rated a dominance of 33.7, while common waterweed scored a 10.7, sago pondweed a 5.9, and chara a 4.9.

Table 23. Little Barbee Lake spring Tier II survey metrics and results as collected June 6, 2007.

Occurrence and abundance of submersed aquatic plant species in Little Barbee Lake.							
Total Sites:	41	Mean species / site:	2.22	Native diversity:		0.65	
Littoral Sites:	38	Maximum species / site:	5	Species diversity:		0.76	
Littoral Depth (ft):	14	Number of species:	8	SE Mean natives / site:		0.15	
Date:	6/6/07	Littoral sites with plants:	38	Mean natives / site:		1.59	
Lake:	Little Barbee	Secchi(ft):	6.5	SE Mean species / site:		0.21	
All depths (0-15')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	85.37	14.63	19.51	4.88	60.98	67.80
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	56.10	43.90	24.39	7.32	24.39	33.66
<i>Elodea canadensis</i>	Common water weed	29.27	70.73	19.51	7.32	2.44	10.73
<i>Stuckenia pectinatus</i>	Sago pondweed	14.63	85.37	7.32	7.32	0.00	5.85
<i>Chara</i> species	Chara species	14.63	85.37	9.76	4.88	0.00	4.88
<i>Vallisneria americana</i>	Eel grass	9.76	90.24	9.76	0.00	0.00	1.95
<i>Potamogeton crispus</i>	Curly-leaf pondweed	7.32	92.68	7.32	0.00	0.00	1.46
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	4.88	95.12	4.88	0.00	0.00	0.98
<i>Filamentous algae</i>	Filamentous algae	60.98					

These same species dominated the various strata within Little Barbee Lake (Appendix C). Coontail was the most frequent and the most dominant species occurring at 94% of the sites in the 0-5 foot stratum with a dominance of 84.7. The frequency of coontail increased in the 5-10 foot stratum with coontail occurring at 100% of the sites. Coontail's dominance remained largely the same rating an 81.5 in the 5-10 foot stratum. Coontail decreased in both frequency and dominance in the 10-15 foot stratum occurring at 54.5% of the sites with a dominance of 25.5. Eurasian watermilfoil followed a similar pattern occurring at 71% of the sites in the 0-5 foot stratum, 62% of the sites in

the 5-10 foot stratum, and 27% of the sites in the 10-15 foot stratum. The dominance of Eurasian watermilfoil also decreased within increasing depth rating dominance scores of 51.8, 33.8, and 5.5 in the 0-5 foot, 5-10 foot, and 10-15 foot strata, respectively. Generally, other submerged species identified in Little Barbee Lake followed a similar pattern. Figures 16-18 document sampling locations (Figure 16) and sites where Eurasian watermilfoil (Figure 17) and curly-leaf pondweed (Figure 18) were identified during the spring survey.

Summer Survey

During the summer survey, JFNew biologists observed that coontail was still the most abundant species in Little Barbee Lake (Table 24). Coontail was found at the highest percentage of sites throughout the entire sampled water column (88%) and also had the dominance (74.5). Eurasian watermilfoil, southern naiad, common waterweed, sago pondweed, and common bladderwort were also relatively common. However, these species occurred in low frequency and dominance when compared to coontail. Eurasian watermilfoil occurred at 10% of the sites, while southern naiad was found at 8% of the sites, and common waterweed, common bladderwort, and sago pondweed occurred at 5% of the sites. All of these species rated a dominance of 2.0 or less.

Table 24. Little Barbee Lake summer Tier II survey metrics and results as collected August 8, 2007.

Occurrence and abundance of submersed aquatic plants in Little Barbee Lake.							
Total Sites:	40	Mean species / site:	1.25	Native diversity:	0.41		
Littoral Sites:	36	Maximum species / site:	4	Species diversity:	0.49		
Littoral Depth (ft):	14	Number of species:	8	SE Mean natives / site:	0.10		
Date:	8/8/07	Littoral sites with plants:	36	Mean natives / site:	1.15		
Lake:	Little Barbee	Secchi(ft):	6.5	SE Mean species / site:	0.12		
All depths (0-15')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	87.50	12.50	12.50	7.50	67.50	74.50
<i>Elodea canadensis</i>	Common water weed	5.00	95.00	2.50	2.50	0.00	2.00
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	10.00	90.00	10.00	0.00	0.00	2.00
<i>Najas guadalupensis</i>	Southern naiad	7.50	92.50	7.50	0.00	0.00	1.50
<i>Utricularia vulgaris</i>	Common bladderwort	5.00	95.00	5.00	0.00	0.00	1.00
<i>Stuckenia pectinatus</i>	Sago pondweed	5.00	95.00	5.00	0.00	0.00	1.00
<i>Myriophyllum exallescens</i>	Northern water milfoil	2.50	97.50	2.50	0.00	0.00	0.50
<i>Chara species</i>	Chara species	2.50	97.50	2.50	0.00	0.00	0.50
<i>Filamentous algae</i>	Filamentous algae	65.00					

Coontail dominated Little Barbee Lake's aquatic plant community at each of the strata as well. Coontail occurred at 89% of the sites in the 0-5 foot strata with a dominance of 86.7. Coontail's frequency increased to occur at 92% of the sites in the 5-10 foot strata, but decreased and occurred at 78% of the sites in the 10-15 foot strata. The dominance of coontail followed a similar pattern with the highest dominance recorded in the shallowest stratum. The dominance of coontail in the 0-5 foot stratum rated an 86.7, while a dominance of 67.7 was recorded in the 5-10 foot stratum, and a dominance of 60.0 was recorded for the 10-15 foot stratum. Eurasian watermilfoil occurred at 17% of the sites in the 0-5 foot stratum and at only 1.5% of the sites in the 5-10 foot stratum. Eurasian watermilfoil was not identified in the 10-15 foot stratum. Sago pondweed and common bladderwort were also relatively frequent in the shallowest stratum occurring at 11% of the sites; however, they

were present in relatively low dominance. These and other species declined in dominance and frequency with increasing depth. Figures 19-20 document sampling locations (Figure 19) and sites where Eurasian watermilfoil (Figure 20) was identified during the summer survey.

Sawmill Lake

Transparency was measured at the deepest spot in the lake using a Secchi disk prior to both sampling events. Transparency was found to be 7.5 (2.3 m) feet during the spring and 7.2 feet (2.2 m) during the summer survey. Based on the survey protocol, plants were sampled to a depth of 15 feet. However, plants were present to a maximum depth of 14 feet during the spring survey. During the summer survey, plants were present to a depth of 10 feet. Forty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Appendix C.

Spring Survey

During the spring survey, coontail dominated the plant community over all sampled depths (0-15 feet; Table 25). Coontail was found at 88% of the sites throughout the entire sampled water column and was present in nearly double the dominance (59.5) of other species identified within Sawmill Lake. Eurasian watermilfoil, curly-leaf pondweed, and chara were also present in relatively high frequency. Eurasian watermilfoil occurred at 49% of the sites, while curly-leaf pondweed was present at 44% of the sites, and chara was identified at 24% of the sites. All of these species were present in relatively low dominance when compared to coontail. Eurasian watermilfoil rated a dominance of 31.2, while curly-leaf pondweed scored an 8.8, and chara rated a 5.9.

Table 25. Sawmill Lake spring Tier II survey metrics and results as collected June 6, 2007.

Occurrence and abundance of submersed aquatic plant species in Sawmill Lake.							
Total Sites:	41	Mean species / site:	2.41	Native diversity:		0.60	
Littoral Sites:	37	Maximum species / site:	7	Species diversity:		0.78	
Littoral Depth (ft):	14	Number of species:	7	SE Mean natives / site:		0.17	
Date:	6/6/07	Littoral sites with plants:	37	Mean natives / site:		1.49	
Lake:	Sawmill	Secchi(ft):	7.5	SE Mean species / site:		0.25	
All depths (0-15')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	87.80	12.20	21.95	26.83	39.02	59.51
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	48.78	51.22	14.63	14.63	19.51	31.22
<i>Potamogeton crispus</i>	Curly-leaf pondweed	43.90	56.10	43.90	0.00	0.00	8.78
<i>Elodea canadensis</i>	Common water weed	14.63	85.37	9.76	2.44	2.44	5.85
<i>Chara</i> species	Chara species	24.39	75.61	21.95	2.44	0.00	5.85
<i>Najas guadalupensis</i>	Southern naiad	12.20	87.80	9.76	2.44	0.00	3.41
<i>Stuckenia pectinatus</i>	Sago pondweed	9.76	90.24	9.76	0.00	0.00	1.95
<i>Filamentous algae</i>	Filamentous algae	75.61					

These same species dominated the various strata within Sawmill Lake (Appendix C1). Coontail was the most frequent and the most dominant species occurring at 94% of the sites in the 0-5 foot stratum with a dominance of 56.3. The frequency of coontail decreased with increasing depth. In the 5-10 foot stratum, coontail occurred at 88% of the sites, while this species occurred at 78% of the sites in the 10-15 foot stratum. Coontail's dominance varied with depth rating a 56.3 in the 0-5 foot stratum, a 72.5 in the 5-10 foot stratum, and a 42.2 in the 10-15 foot stratum. Eurasian watermilfoil

followed a similar pattern occurring at 63% of the sites in the 0-5 foot stratum, 50% of the sites in the 5-10 foot stratum, and 22% of the sites in the 10-15 foot stratum. The dominance of Eurasian watermilfoil also decreased within increasing depth rating dominance scores of 40.0, 35.0, and 8.9 in the 0-5 foot, 5-10 foot, and 10-15 foot strata, respectively. Generally, other submerged species identified in Sawmill Lake followed a similar pattern. Chara and curly-leaf pondweed were both relatively frequent in the shallowest stratum occurring at 50% of the sites. This frequency remained constant for curly-leaf pondweed but decreased for chara in the 5-10 foot stratum. Curly-leaf pondweed's frequency declined again in the 10-15 foot stratum, while chara was absent from this stratum. Figures 16-18 document sampling locations (Figure 16) and sites where Eurasian watermilfoil (Figure 17) and curly-leaf pondweed (Figure 18) were identified during the spring survey.

Summer Survey

During the summer survey, coontail again dominated the plant community over all sampled depths (0-15 feet; Table 26). Coontail was found at 98% of the sites throughout the entire sampled water column and was present in nearly ten times the dominance (61.5) of other species identified within Sawmill Lake. Eurasian watermilfoil, southern naiad, and sago pondweed were also present in relatively high frequency. Eurasian watermilfoil occurred at 27% of the sites, while southern naiad was present at 19% of the sites, and sago pondweed was identified at 19% of the sites. All of these species were present in relatively low dominance when compared to coontail. Eurasian watermilfoil rated a dominance of 6.3, while southern naiad scored a 5.9, and sago pondweed rated a 2.9.

Table 26. Sawmill Lake summer Tier II survey metrics and results as collected August 24, 2007.

Occurrence and abundance of submersed aquatic plants in Sawmill Lake.							
Total Sites:	41	Mean species / site:	1.88	Native diversity:	0.60		
Littoral Sites:	41	Maximum species / site:	4	Species diversity:	0.69		
Littoral Depth (ft):	10	Number of species:	9	SE Mean natives / site:	0.13		
Date:	8/24/07	Littoral sites with plants:	41	Mean natives / site:	1.61		
Lake:	Sawmill	Secchi(ft):	7.2	SE Mean species / site:	0.14		
All depths (0-10')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	97.56	2.44	31.71	26.83	39.02	61.46
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	26.83	73.17	24.39	2.44	0.00	6.34
<i>Najas guadalupensis</i>	Southern naiad	19.51	80.49	14.63	4.88	0.00	5.85
<i>Stuckenia pectinatus</i>	Sago pondweed	14.63	85.37	14.63	0.00	0.00	2.93
<i>Utricularia vulgaris</i>	Common bladderwort	9.76	90.24	9.76	0.00	0.00	1.95
<i>Elodea canadensis</i>	Common water weed	7.32	92.68	7.32	0.00	0.00	1.46
<i>Najas flexilis</i>	Slender naiad	4.88	95.12	4.88	0.00	0.00	0.98
<i>Chara</i> species	Chara species	4.88	95.12	4.88	0.00	0.00	0.98
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	2.44	97.56	2.44	0.00	0.00	0.49
<i>Filamentous algae</i>	Filamentous algae	92.68					

Coontail dominated Sawmill Lake's aquatic plant community at each of the strata as well. Coontail occurred at 96% of the sites in the 0-5 foot strata with a dominance of 56.0. Coontail's frequency increased to occur at 100% of the sites in the 5-10 foot stratum. The dominance of also increased with increasing depth. Coontail recorded a dominance of 70.0 in the 5-10 foot stratum. Eurasian

watermilfoil and sago pondweed occurred at 24% of the sites in the 0-5 foot stratum. Eurasian watermilfoil's frequency increased within increased depth occurring at 31.3% of the sites in the 5-10 foot stratum, while sago pondweed was not identified in the 5-10 foot stratum. Southern naiad was also relatively frequent in the shallowest stratum occurring at 20% of the sites; however, like other species, southern naiad was present in relatively low dominance (7.2). These and other species declined in dominance and frequency with increasing depth. Figures 19-20 document sampling locations (Figure 19) and sites where Eurasian watermilfoil (Figure 20) was identified during the summer survey.

Sechrist Lake

Transparency was measured at the deepest spot in the lake using a Secchi disk prior to both sampling events. Transparency was found to be 13.2 (4.0 m) feet during the spring and 9.5 feet (2.9 m) during the summer survey. Based on the survey protocol, plants were sampled to a depth of 20 feet. However, plants were present to a maximum depth of 20 feet during both the spring and summer surveys. Fifty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Appendix C.

Spring Survey

During the spring survey, 17 submerged species were identified within Sechrist Lake (Table 27). (Figure 16 documents the sampling locations for the spring survey of Sechrist Lake.) Of these, various-leaf watermilfoil and eel grass dominated the plant community over all sampled depths (0-20 feet). Various-leaf watermilfoil was the second most prevalent species found at the highest percentage of sites throughout the entire sampled water column (46%) but had the highest dominance (23.6) and relative density (1.18). Conversely, eel grass was the most prevalent species which was located at 52% of the sites, but possessed the second highest dominance (20.0). Throughout the water column, chara, curly-leaf pondweed, and coontail were relatively dense and were found at 32%, 32%, and 26% of the sites, respectively (Table 27). However, these species were present in relatively low dominance compared to the dominance of eel grass and various-leaf watermilfoil. In total, eight pondweed species were identified during the Tier II survey of Sechrist Lake. All of these species as well as nitella, northern watermilfoil, southern naiad, and Eurasian watermilfoil were found at less than 18% of the sites in relatively low dominance (4.4 or less).

Table 27. Sechrist Lake spring Tier II survey metrics and results as collected June 6, 2007.

Occurrence and abundance of submersed aquatic plant species in Sechrist Lake.							
Total Sites:	50	Mean species / site:	2.74	Native diversity:	0.87		
Littoral Sites:	43	Maximum species / site:	6	Species diversity:	0.89		
Littoral Depth (ft):	20	Number of species:	16	SE Mean natives / site:	0.22		
Date:	6/6/07	Littoral sites with plants:	43	Mean natives / site:	2.40		
Lake:	Sechrist	Secchi(ft):	13.2	SE Mean species / site:	0.25		
All depths (0-20')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	46.00	54.00	22.00	12.00	12.00	23.60
<i>Vallisneria americana</i>	Eel grass	52.00	48.00	34.00	12.00	6.00	20.00
<i>Chara</i> species	Chara species	32.00	68.00	20.00	8.00	4.00	12.80
<i>Potamogeton crispus</i>	Curly-leaf pondweed	32.00	68.00	22.00	6.00	4.00	12.00
<i>Ceratophyllum demersum</i>	Coontail	26.00	74.00	18.00	4.00	4.00	10.00
<i>Potamogeton nodosus</i>	Long-leaf pondweed	18.00	82.00	16.00	2.00	0.00	4.40

<i>Potamogeton amplifolius</i>	Large-leaf pondweed	16.00	84.00	14.00	2.00	0.00	4.00
<i>Potamogeton illinoensis</i>	Illinois pondweed	12.00	88.00	12.00	0.00	0.00	2.40
<i>Nitella species</i>	Nitella species	8.00	92.00	6.00	2.00	0.00	2.40
<i>Myriophyllum exalbescent</i>	Northern watermilfoil	2.00	98.00	0.00	0.00	2.00	2.00
<i>Najas guadalupensis</i>	Southern naiad	8.00	92.00	8.00	0.00	0.00	1.60
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	8.00	92.00	8.00	0.00	0.00	1.60
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	2.00	98.00	0.00	2.00	0.00	1.20
<i>Potamogeton gramineus</i>	Grassy pondweed	6.00	94.00	6.00	0.00	0.00	1.20
<i>Stuckenia pectinatus</i>	Sago pondweed	4.00	96.00	4.00	0.00	0.00	0.80
<i>Potamogeton praelongus</i>	White-stemmed pondweed	2.00	98.00	2.00	0.00	0.00	0.40
<i>Filamentous algae</i>	Filamentous algae	16.00					

Chara and eel grass were co-dominant in the shallowest stratum (0-5 foot). These species were identified at 73% and 82% of the sites, respectively with dominances of 40.0 and 30.9, respectively. These species were nearly twice as frequent and twice as dominant as any other species identified in the 0-5 foot stratum. Large-leaf pondweed, various-leaf watermilfoil, long-leaf pondweed, Illinois pondweed, and curly-leaf pondweed were relatively frequent in the shallowest stratum of Sechrist Lake with each species identified at 45%, 36%, 36%, 27%, and 27% of the sites, respectively. However, none of these species were present in very high dominance. Various-leaf watermilfoil possessed the highest dominance of these species (dominance of 21.8); however, all of the other species occurred with a dominance of 9.1 or less.

Although chara and eel grass dominated the shallowest stratum of Sechrist Lake, both chara and eel grass' dominance decreased with increasing depth. Various-leaf watermilfoil dominated the 5-10 foot stratum occurring at 80% of the sites with a dominance of 48.0. Eel grass, chara, and curly-leaf pondweed were relatively frequent and relatively dominant. Eel grass, chara, and curly-leaf pondweed occurred at 67%, 47%, and 40% of the sites in the 5-10 foot stratum, respectively. These species score a 21.3, 12.0, and 16.0, respectively in regards to overall dominance. All other species were present in relatively low dominance and frequency occurring at 26% of the sites or less with dominances of 9.3 or less. In deeper water, the aquatic plant community continued to change in variety. Initially, eel grass maintained its high frequency and dominance; however, both frequency and dominance of this species decreased with increasing depth. Eel grass was present at 36% of the sites with a dominance of 21.8 in the 10-15 foot stratum; however, this species was present at 27% of the sites with a dominance of 9.1 in the 15-20 foot stratum. Curly-leaf pondweed dominated the aquatic plant community occurring at 46% of the sites (dominance of 12.7) in the 10-15 foot stratum and at 18% of the sites in the 15-20 foot stratum. Various-leaf watermilfoil and coontail increased in dominance and frequency in Sechrist Lake's lower strata with both species occurring at 27% of the sites with a dominance of 9.1 in the 10-15 foot stratum. Coontail was the most dominant species in the 15-20 foot stratum occurring at 64% of the sites in relatively high dominance (23.6).

Two exotic species were present in Sechrist Lake during the spring survey: curly-leaf pondweed and Eurasian watermilfoil. As previously discussed, curly-leaf pondweed was relatively frequent and relatively dense throughout the water column. Eurasian watermilfoil was present in relatively low dominance throughout the water column. Eurasian watermilfoil was present at 2% of the sites in the 0-5 foot stratum, was absent in the 5-10 foot stratum, occurred at 9% of the sites in the 10-15 foot stratum, and was absent from the 15-20 foot stratum. The dominance of curly-leaf pondweed also varied throughout the water column with this species occurring at 27% to 40% of the sites

within each stratum. Figures 17 and 18 document sites where Eurasian watermilfoil (Figure 17) and curly-leaf pondweed (Figure 18) were identified during the spring survey. The locations and dominance of other species are documented in Appendix D.

Summer Survey

During the summer survey, 17 submerged species were identified within Sechrist Lake (Table 28). (Figure 19 documents the sampling locations for the summer survey of Sechrist Lake.) Of these species, eel grass and sago pondweed dominated the plant community over all sampled depths (0-20 feet). These species were found at the highest percentage of sites throughout the entire sampled water column (37%) and also had the highest dominances (19.6 and 15.5, respectively). Throughout the entire sampled water column, coontail, various-leaf watermilfoil, chara, flat-stem pondweed, and southern naiad were relatively dense and were found at 33%, 33%, 27%, 20%, and 16% of the sites, respectively (Table 28). In total, seven pondweed species were identified during the Tier II survey of Sechrist Lake. With the exception of flat-stem pondweed, the other pondweed species as well as other submerged aquatic species occurred at 14% of sites or less with dominances measuring 5.7 or less (Table 28).

Table 28. Sechrist Lake summer Tier II survey metrics and results as collected August 24, 2007.

Occurrence and abundance of submersed aquatic plants in Sechrist Lake.							
Total Sites:	49	Mean species / site:	2.71	Native diversity:	0.91		
Littoral Sites:	48	Maximum species / site:	8	Species diversity:	0.91		
Littoral Depth (ft):	20	Number of species:	16	SE Mean natives / site:	0.27		
Date:	8/24/07	Littoral sites with plants:	44	Mean natives / site:	2.69		
Lake:	Sechrist	Secchi(ft):	9.5	SE Mean species / site:	0.27		
All depths (0-20')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Vallisneria americana</i>	Eel grass	36.73	63.27	16.33	10.20	10.20	19.59
<i>Stuckenia pectinatus</i>	Sago pondweed	36.73	63.27	24.49	4.08	8.16	15.51
<i>Chara</i> species	Chara species	28.57	71.43	14.29	10.20	4.08	13.06
<i>Ceratophyllum demersum</i>	Coontail	32.65	67.35	20.41	10.20	2.04	12.24
<i>Myriophyllum heterophyllum</i>	Various-leaf water milfoil	32.65	67.35	24.49	6.12	2.04	10.61
<i>Najas guadalupensis</i>	Southern naiad	16.33	83.67	12.24	2.04	2.04	5.71
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	20.41	79.59	18.37	2.04	0.00	4.90
<i>Heteranthera dubia</i>	Water star grass	14.29	85.71	14.29	0.00	0.00	2.86
<i>Potamogeton praelongus</i>	White-stemmed pondweed	12.24	87.76	12.24	0.00	0.00	2.45
<i>Nitella</i> species	Nitella species	12.24	87.76	12.24	0.00	0.00	2.45
<i>Potamogeton richardsonii</i>	Richardson's pondweed	2.04	97.96	0.00	0.00	2.04	2.04
<i>Potamogeton illinoensis</i>	Illinois pondweed	10.20	89.80	10.20	0.00	0.00	2.04
<i>Potamogeton gramineus</i>	Grassy pondweed	10.20	89.80	10.20	0.00	0.00	2.04
<i>Potamogeton berchtoldii</i>	Small pondweed	6.12	93.88	6.12	0.00	0.00	1.22
<i>Najas flexilis</i>	Slender naiad	2.04	97.96	2.04	0.00	0.00	0.41
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	2.04	97.96	2.04	0.00	0.00	0.41
<i>Filamentous algae</i>	Filamentous algae	12.24					

Eel grass, chara, and sago pondweed dominated the shallowest stratum (0-5 foot). Sago pondweed was the most prevalent species being identified at 75% of the sites. However, sago pondweed

possessed the third highest dominance (32.5). Eel grass was identified at 69% of the sites in this stratum and also possessed the highest dominance (38.8). Chara was also prevalent in the 0-5 foot stratum and was present at 63% of the sampled sites with a dominance of 35.0. Various-leaf watermilfoil (44%; 18.8), white-stem pondweed, southern naiad, and grassy pondweed (25%, 5.0), and coontail and Illinois pondweed (19%, 3.8) were also relatively prevalent; however, all of these species occurred in relatively low frequency.

In deeper water, the aquatic plant community continued to change in variety. Initially, eel grass and sago pondweed maintained their relatively high frequency and dominance; however, both frequency and dominance of these species decreased with increasing depth. Eel grass was present at 46% of the sites (dominance of 27.3) in the 5-10 foot stratum, but was absent from the 10-15 foot stratum, and occurred at only 10% of the sites in the 15-20 foot stratum. Likewise, sago pondweed occurred at 36% of the sites in the 5-10 foot stratum, but was only present at 9% of the sites in the 10-15 foot stratum. Sago pondweed was absent from the 15-20 foot stratum. Coontail, flat-stem pondweed, and various-leaf watermilfoil all increase in frequency and dominance with increasing depth. Coontail occurred at 72% of the sites with a dominance of 36.4 in the 10-15 foot stratum and occurred at 40% of sites with a dominance of 12.0 in the 15-20 foot stratum. Nitella was also relatively frequent in the 10-15 foot stratum (18%) but occurred in relatively low dominance (3.6) but increased in both frequency and dominance (40%, 8.0) in the 15-20 foot stratum.

Only one exotic species was present in Sechrist Lake during the summer survey: Eurasian watermilfoil. Eurasian watermilfoil was present in relatively low dominance throughout the entire sampled water column. Eurasian watermilfoil was present at 2% of the sites overall and occurred only in the 5-10 foot stratum during the summer survey. Figure 20 documents sites where Eurasian watermilfoil were identified during the summer survey. The locations and dominance of other species are documented in Appendix D.

8.2.3 Current and Historic Data Comparison

When recently collected data is compared with data reported by Pearson (2004), in general the Barbee Lakes possess greater diversity than the lakes surveyed by Pearson (Table 29). All lakes except Little Barbee and Sawmill lakes possessed higher numbers of native species and numbers of species overall during the spring survey than those identified on average in Pearson's study. During the summer survey (Table 30), Big Barbee, Irish, Kuhn, and Sechrist lakes possessed higher numbers of native species and higher numbers of species overall than lakes in Pearson's study. The Barbee Lakes also possessed greater rake diversity, greater native rake diversity, and greater native and overall species richness than those recorded during Pearson's survey.

Table 29. A comparison of the pre-treatment aquatic plant communities in the Barbee Lakes to the average values for plant community metrics found by Pearson (2004) in his survey of 21 northern Indiana lakes. Bolding indicates that the value exceeds Pearson average.

Metric	Banning Lake	Big Barbee Lake	Irish Lake	Kuhn Lake	Little Barbee Lake	Sawmill Lake	Sechrist Lake	Indiana Average
Number of species collected	10	13	14	16	8	7	16	8
Number of native species	8	11	12	14	6	5	14	7
Species Richness	1.22	2.97	2.94	3.08	2.22	2.41	2.74	0.66
Native Species Richness	0.88	2.18	2.34	2.62	1.59	1.49	2.40	0.56
Rake Diversity (SDI)	0.85	0.84	0.87	0.88	0.76	0.78	0.89	0.62
Native Rake Diversity (SDI)	0.81	0.78	0.84	0.87	0.65	0.60	0.87	0.5

Table 30. A comparison of the post-treatment aquatic plant communities in the Barbee Lakes to the average values for plant community metrics found by Pearson (2004) in his survey of 21 northern Indiana lakes. Bolding indicates that the value exceeds Pearson average.

Metric	Banning Lake	Big Barbee Lake	Irish Lake	Kuhn Lake	Little Barbee Lake	Sawmill Lake	Sechrist Lake	Indiana Average
Number of species collected	7	11	16	19	8	9	16	8
Number of native species	6	10	15	18	7	8	15	7
Species Richness	1.14	1.47	2.77	3.02	1.25	1.88	2.65	0.66
Native Species Richness	1.03	1.42	2.67	3.00	1.15	1.61	2.63	0.56
Rake Diversity (SDI)	0.80	0.63	0.84	0.89	0.49	0.69	0.91	0.62
Native Rake Diversity (SDI)	0.76	0.61	0.83	0.89	0.41	0.60	0.91	0.5

The effects of the treatment on the native aquatic plant community are unclear. Comparing the 2007 spring and summer Tier II survey metrics indicates that the quality of the native aquatic plant community in the Barbee Lakes generally decreased following treatment. In all lakes except Kuhn and Sechrist lakes, the native rake diversity (SDI), native species richness, and site species native diversity all decreased following treatment. However, the number of native plant species found in all lakes except Banning Lake increased from the spring to the summer surveys. The first three factors suggest a decline in the native plant community following treatment while the latter suggests improvements in the native community. Additionally, one variable, which may be masking the true effect of the herbicide application, is the seasonal variation in plant biomass as the Tier II survey conducted by JFNew occurred in August, which is the expected time of peak seasonal biomass (Pearson, 2004). Other temporal variables that may impact plant bed composition include increased boat traffic, predation, and physical stressors such as increased temperatures as the season progressed. Additionally, natural variations of the plant community throughout the littoral zone may also explain the initial decline as the IDNR used different survey points than those used by JFNew.

8.3 Macrophyte Inventory Discussion

The primary focus of an aquatic vegetation management plan is to document changes within the aquatic plant community pre- and post-treatment and to develop plans for future work. Curly-leaf

pondweed and Eurasian watermilfoil were the two exotic species targeted in the herbicide treatment that occurred on May 10 and June 12 and 13, 2007, respectively. Within each lake and throughout the chain, the Barbee Lakes underwent a decrease in both the relative density and site abundance of curly-leaf pondweed and Eurasian watermilfoil.

Since we cannot account for all the spatial variables impacting the plant community, such as boat-traffic and changes in nutrient availability, or for temporal variables like climactic conditions, including temperature and precipitation levels, an exact and precise analysis regarding the impact of herbicide treatment upon the Barbee Lakes' aquatic plant community is not possible. Still, general trends emerge from the data that are useful for the purpose of management decisions. When comparing data for Eurasian watermilfoil, site frequencies, mean and relative densities, and dominance, no clear pattern can be determined. When the 2005 and 2007 data are compared, increases in spring Eurasian watermilfoil frequencies were observed in Banning, Big Barbee, Irish, Little Barbee, and Sawmill lakes. Site frequencies observed in 2007 were nearly double those observed in 2005. Additionally, Eurasian watermilfoil was not observed in Kuhn and Sechrist lakes in 2005, but was present in 2007. Relative and mean densities also increased from the spring 2005 to the spring 2007 assessments. This suggests that Eurasian watermilfoil populations are increasing on an annual basis. However, summer survey data neither supports nor refutes this trend. Site frequencies, mean densities, and dominance scores calculated for summer survey data increased in Banning, Irish, and Sawmill lakes, remained relatively stable in Little Barbee Lake, and declined in Big Barbee Lake. This suggests that the Eurasian watermilfoil population is changing in both density and distribution but does not allow for adequate determination of patterns at this time (Table 31).

Table 31. Variation in site frequency, relative and mean density, and dominance of Eurasian watermilfoil in the Barbee Lakes from 2005 to 2007.

Common Name	Date	Site Frequency	Relative Density	Mean Density	Dominance
Banning Lake	5/5/05	7.7	0.08	1.00	--
	8/18/05	--	--	--	--
	6/7/07	24.0	0.68	2.83	13.6
	8/24/07	10.3	0.10	1.00	2.1
Big Barbee Lake	5/5/05	33.3	0.78	2.20	--
	8/18/05	10.0	0.34	2.83	--
	6/8/07	50.0	1.41	2.82	28.2
	8/8/07	4.1	0.04	1.00	0.8
Irish Lake	5/6/05	19.0	0.61	2.45	--
	8/18/05	4.0	0.24	5.00	--
	6/7/07	46.0	1.06	2.30	21.2
	8/8/07	10.4	0.10	1.00	2.1
Kuhn Lake	5/6/05	--	--	--	--
	8/18/05	--	--	--	--
	6/8/07	4.0	0.12	3.00	2.4
	8/8/07	2.1	0.02	1.00	0.4

Common Name	Date	Site Frequency	Relative Density	Mean Density	Dominance
Little Barbee Lake	5/6/05	27.5	1.00	3.18	--
	8/18/05	10.0	0.28	2.33	
	6/7/07	56.1	1.68	3.00	33.7
	8/8/07	10.0	0.10	1.00	2.0
Sawmill Lake	5/5/05	24.0	0.42	1.33	--
	8/18/05	16.7	0.71	3.00	--
	6/7/07	48.8	1.56	3.20	31.2
	8/24/07	26.8	0.32	1.18	6.3
Sechrist Lake	5/5/05	--	--	--	--
	8/18/05	--	--	--	--
	6/7/07	2.0	0.06	3.00	1.2
	8/24/07	2.0	0.02	1.00	0.4

Source: Weed Patrol, Inc. 2005 ; JFNew, 2007. -- indicates no data is available

Though comparative data is lacking, comparing curly-leaf pondweed data, a decline in frequency, density, and distribution is suggested in all lakes. This holds true for all lakes except Kuhn Lake, where the frequency increased from 2005 to 2007, and Sechrist Lake, where curly-leaf pondweed was not identified in 2005 (Table 32).

Table 32. Variation in site frequency, relative and mean density, and dominance of curly-leaf pondweed in the Barbee Lakes from 2005 to 2007.

Common Name	Date	Site Frequency	Relative Density	Mean Density	Dominance
Banning Lake	5/5/05	--	--	--	--
	8/18/05	--	--	--	--
	6/7/07	10.0	0.10	1.00	2.0
	8/24/07	--	--	--	--
Big Barbee Lake	5/5/05	61.7	2.02	3.11	--
	8/18/05	--	--	--	--
	6/8/07	29.4	0.41	1.40	8.2
	8/8/07	--	--	--	--
Irish Lake	5/6/05	39.7	0.86	1.65	--
	8/18/05	6.00	0.14	2.00	--
	6/7/07	14.0	0.14	1.00	2.8
	8/8/07	--	--	--	--
Kuhn Lake	5/6/05	22.5	0.45	1.89	--
	8/18/05	--	--	--	--
	6/8/07	42.0	0.70	1.67	14.0
	8/8/07	--	--	--	--
Little Barbee Lake	5/6/05	60.0	2.03	2.96	--
	8/18/05	--	--	--	--
	6/7/07	7.3	0.07	1.00	1.5
	8/8/07	--	--	--	--

Common Name	Date	Site Frequency	Relative Density	Mean Density	Dominance
Sawmill Lake	5/5/05	60.0	2.21	1.33	--
	8/18/05	--	--	--	--
	6/7/07	43.9	0.44	1.00	8.8
	8/24/07	--	--	--	--
Sechrist Lake	5/5/05	--	--	--	--
	8/18/05	--	--	--	--
	6/7/07	32.0	0.60	1.88	12.0
	8/24/07	--	--	--	--

Source: Weed Patrol, Inc. 2005 ; JFNew, 2007. -- indicates no data is available

Finally, it is difficult to determine how the native aquatic plant communities within the Barbee Lakes are responding to herbicide treatment as only four data sets spanning three growing seasons have been collected. Furthermore, these data sets are separated by one growing season each. A more complete data set should allow for better determination of the plant community's response to treatment methodologies in the Barbee Lakes.

9.0 Aquatic Vegetation Management Alternatives

A good aquatic plant management plan includes a variety of management techniques applicable to different parts of a lake depending on the lake's water quality, the characteristics of the plant community in different parts of the lake, and lake users' goals for different parts of the lake. Many aquatic plant management techniques, including chemical control, harvesting, and biological control, require a permit from the IDNR. Depending on the size and location of the treatment area, even individual residents may need a permit to conduct a treatment. Residents should contact the IDNR Division of Fish and Wildlife before conducting any treatment.

The following paragraphs describe some aquatic plant management techniques that may be applicable to the Barbee Lakes, given their specific ecological condition. The alternatives that will be discussed include no action, institutional protection, environmental manipulation, nutrient reduction, mechanical harvesting, bottom covers, biological control, chemical control, and preventive measures.

9.1 No Action

Herbicide applications have been used long-term at the Barbee Lakes to control Eurasian watermilfoil and curly-leaf pondweed. With no change in treatment type or methodology, these treatments will likely continue. However, the no action alternative really defines that no treatment will occur. Without any treatment, exotic species will continue to grow unchecked throughout the Barbee Lakes resulting in a species population that is at a minimum the same size or larger than that observed during the 2007 surveys. This will likely result in a decrease in native plant density and diversity, the formation of a monoculture of exotic species, and a loss of any high quality species that may be present in the Barbee Lakes. Additionally, the growth of these nuisance species could increase nutrient cycling within the Barbee Lakes thereby making more nutrients available to plants and algae ultimately resulting in a decline in the lake's water quality. This would likely eventually result in reduced access for shoreline and offshore users and overall limit recreational access.

9.2 Institutional Protection of Beneficial Vegetation

Invasive species often colonize disturbed areas first before moving to other areas of the lake. The protection of native and/or beneficial aquatic vegetation can prevent the growth of exotic or nuisance species. This can be accomplished in two ways: limiting user impacts to beneficial plants due to boating or recreational uses and not over-treating beneficial plant beds. Users can restrict the use of specific areas of the Barbee Lakes through the use of buoys or the establishment of user zones. The second methodology, over-treating of native plant beds, could be a concern in the Barbee Lakes in the future. This issue occurs when a beneficial, native plant bed is deemed to be a nuisance and treatment of this area begins. Once the native plant community is weakened through treatment, exotic species can move into these areas colonizing open sediment. Once a foothold is established, the aggressive, exotic species can then out-compete native varieties. As aquatic plant treatment at the Barbee Lakes has occurred on a large-scale historically, this may have been an issue in the past and could continue to be an issue in the future. The Barbee Lakes Association should be aware of this issue and tailor their treatment efforts to not impact beneficial native species.

9.3 Environmental Manipulation/Water Level Manipulation

Environmental manipulation often refers to manipulating the lake's water level to control vegetation. This occurs by raising water levels resulting in drowning the plants or lowering the water level to freeze or heat the aquatic plant community. This type of treatment is limited to lakes where water levels are easily manipulated. Water level manipulation can be effective at controlling exotic or

invasive species in the Barbee lakes; however, this treatment will be no more or less effective for exotic or invasive native species. Additionally, exotic or invasive species may colonize newly exposed substrate resulting from water level manipulation. The Barbee Lakes' water control structure does not offer ease of water-level manipulation. However, this has occurred in the past when dam repair was completed and therefore, could be used again in the future.

9.4 Nutrient Reduction

Like terrestrial vegetation, aquatic vegetation has several habitat requirements that need to be satisfied in order for the plants to grow or thrive. Aquatic plants depend on sunlight as an energy source. The amount of sunlight available to plants decreases with depth of water as algae, sediment, and other suspended particles block light penetration. Consequently, most aquatic plants are limited to maximum water depths of approximately 10-15 feet (3-4.5 m), but some species, such as Eurasian watermilfoil, have a greater tolerance for lower light levels and can grow in water deeper than 32 feet (10 m) (Aikens et al., 1979). Hydrostatic pressure rather than light often limits plant growth at deeper water depths (15-20 feet or 4.5-6 m).

Water clarity affects the ability of sunlight to reach plants, even those rooted in shallow water. Lakes with clearer water have an increased potential for plant growth. Kuhn, Sechrist, and Irish lakes possess better water clarity than the average Indiana lake. In these lakes, aquatic plant growth can occur in greater water depths than in lakes like Big and Little Barbee and Sawmill, where the water clarity is poor. As a general rule of thumb, rooted plant growth is restricted to the portion of the lake where water depth is less than or equal to 2 to 3 times the lake's Secchi disk depth. This generally holds true in the Barbee Lakes.

Aquatic plants also require a steady source of nutrients for survival. Many aquatic plants, also known as aquatic macrophytes, differ from microscopic algae (which are also plants) in their uptake of nutrients. Aquatic macrophytes receive most of their nutrients from the sediments via their root systems rather than directly utilizing nutrients in the surrounding water column. Some competition with algae for nutrients in the water column does occur. The amount of nutrients taken from the water column varies for each macrophyte species. Because macrophytes obtain most of their nutrients from the sediments, lakes, which receive high watershed inputs of nutrients to the water column, will not necessarily have aquatic macrophyte problems. However, lakes with large sources of readily-available nutrients (phosphorus and nitrogen), typically contain higher density aquatic plant communities. Reductions in nutrients can both increase and decrease aquatic plant density. Increases in plant density occur due to improved water clarity, which often results in more plant growth. Many of the Barbee Lakes contain relatively high nutrient levels and therefore would be expected to contain a high density aquatic plant community. This is the case in Sawmill and Big Barbee lakes where the large watershed to lake area ratio and the high nutrient loading creates a dense aquatic plant community comprised of relatively tolerant species. However, in Kuhn and Sechrist lakes, where the watershed to lake area ratio and nutrient loading is much lower the aquatic plant communities are much more diverse and comprised of species that are considered higher quality and intolerant to high nutrient concentrations. In the other lakes, moderate light penetration and a reservoir of nutrients provide a relatively dense and very diverse community. The reduction of nutrient inputs to the Barbee Lakes will likely not alter the aquatic plant community as a whole. Rather, localized effects of the nutrient reduction will likely occur in the areas of the lake closest to the change in nutrient resources.

9.5 Mechanical Harvesting

Harvesting involves the physical removal of vegetation from lakes. Harvesting should also be viewed as a short-term management strategy. Like chemical control, harvesting needs to be repeated yearly and sometimes several times within the same year. (Some carry-over from the previous year has occurred in certain lakes.) Despite this, harvesting is often an attractive management technique because it can provide lake users with immediate access to areas and activities that have been affected by excessive plant growth. Mechanical harvesting is also beneficial in situations where removal of plant biomass will improve a lake's water chemistry. (Chemical control leaves dead plant biomass in the lake to decay and consume valuable oxygen.)

Macrophyte response to harvesting often depends upon the species of plant and particular way in which the management technique is performed. Pondweeds, which rely on sexual reproduction for propagation, can be managed successfully through harvesting. However, many harvested plants, especially milfoil, can re-root or reproduce vegetatively from the cut pieces left in the water. Plants harvested several times during the growing season, especially late in the season, often grow more slowly the following season (Cooke et al., 1993). Harvesting plants at their roots is usually more effective than harvesting higher up on their stems (Olem and Flock, 1990). This is especially true with Eurasian watermilfoil and curly-leaf pondweed. Benefits are also derived if the cut plants and the nutrients they contain are removed from the lake. Harvested vegetation that is cut and left in the lake ultimately decomposes, contributing nutrients and consuming oxygen.

Hand harvesting may be the most economical means of harvesting on the Barbee Lakes. Hand harvesting is recommended in small areas where human uses are hampered by extensive growths (docks, piers, beaches, boat ramps). In these small areas, plants can be efficiently cut and removed from the lake with hand cutters such as the Aqua Weed Cutter (Figure 21). In less than one hour every 2-3 weeks, a homeowner can harvest 'weeds' from along docks and piers. Depending on the model, hand-harvesting equipment for smaller areas cost from \$50 to \$1500 (McComas, 1993). To reduce the cost, several homeowners can invest together in such a cutter. Alternatively, a lake association may purchase one for its members. This sharing has worked on other Indiana lakes with aquatic plant problems. Use of a hand harvester is more efficient and quick-acting, and less toxic for small areas than spot herbicide treatments. Hand harvesting or using a boat-mounted mechanical harvester to harvest vegetation covering areas larger than 625 square feet requires a permit from the IDNR Division of Fish and Wildlife. (The IDNR Division of Fish & Wildlife can assist lake residents in determining whether a permit is needed and how to obtain one.)

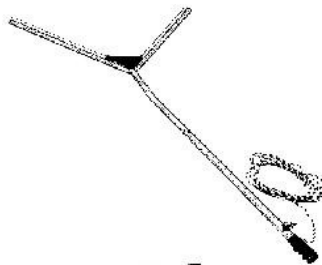


Figure 21. An aquatic weed cutter designed to cut emergent weeds along the edge of ponds. It has a 48" cutting width, uses heavy-duty stainless steel blades, can be sharpened, and comes with an attached 20' rope and blade covers.

9.6 Bottom Covers

Bottom shading by covering bottom sediments with fiberglass or plastic sheeting materials provides a physical barrier to macrophyte growth. Buoyancy and permeability are key characteristics of the various sheeting materials. Buoyant materials (polyethylene and polypropylene) are generally more difficult to apply and must be weighted down. Unfortunately, sand or gravel anchors used to hold buoyant materials in place can act as substrate for new macrophyte growth. Any bottom cover materials placed on the lake bottom must be permeable to allow gases to escape from the sediments; gas escape holes must be cut in impermeable liners. Commercially available sheets made of fiberglass-coated screen, coated polypropylene, and synthetic rubber are non-buoyant and allow gases to escape, but cost more (up to \$66,000 per acre or \$163,000 per hectare for materials, Cooke and Kennedy, 1989). Indiana regulations specifically prohibit the use of bottom covering material as a base for beaches.

Due to the prohibitive cost of the sheeting materials, sediment covering is recommended for only small portions of lakes, such as around docks, beaches, or boat mooring areas. This technique may be ineffective in areas of high sedimentation, since sediment accumulated on the sheeting material provides a substrate for macrophyte growth. The IDNR requires a permit for any permanent structure on the lake bottom, including anchored sheeting.

9.7 Biological Control

Biological control involves the use of one species to control another species. Often when a plant species that is native to another part of the world is introduced to a new region with suitable habitat, it grows rapidly because its native predators have not been introduced to the new region along with the plant species. This is the case with some of the common pest plants in northeast Indiana such as Eurasian watermilfoil and purple loosestrife. Neither of these species is native to Indiana, yet both exist in and around Kosciusko County.

Researchers have studied the ability of various insect species to control both Eurasian watermilfoil and purple loosestrife. Cooke et al. (1993) points to four different species that may reduce Eurasian watermilfoil infestations: *Trienodes tarda*, a caddisfly, *Cricotopus myriophylli*, a midge, *Acentria nivea*, a moth and *Litodactylus leucogaster*, a weevil. Recent research efforts have focused on the potential for *Eubrychiopsis lecontei*, a native weevil, to control Eurasian watermilfoil. Purple loosestrife biocontrol researchers have examined the potential for three insects, *Gallerucella californiensis*, *G. pusilla*, and *Hylobius transversovittatus*, to control the plant.

While the population of purple loosestrife around the Barbee Lakes is relatively small and therefore may not be suitable for biological control efforts, it may be worthwhile for Barbee Lakes' residents to understand the common biocontrol mechanisms for this species should the situation on the lake change. Likewise, as Eurasian watermilfoil is present in the Barbee Lakes, residents should be cognizant of infestation issues and biocontrol mechanisms for Eurasian watermilfoil. Therefore, treatment options for the plant are discussed below merely as reference material for use in case of future infestation. Residents should also be aware that under new regulations an IDNR permit is required for the implementation of a biological control program on a lake.

9.7.1 Biological Control of Eurasian Watermilfoil

Eubrychiopsis lecontei has been implicated in a reduction of Eurasian watermilfoil in several Northeastern and Midwestern lakes (USEPA, 1997). *E. lecontei* weevils reduce milfoil biomass by two means: one, both adult and larval stages of the weevil eat different portions of the plant and

two, tunneling by weevil larvae cause the plant to lose buoyancy and collapse, limiting its ability to reach sunlight. The weevils' actions also cut off the flow of carbohydrates to the plant's root crowns impairing the plant's ability to store carbohydrates for over wintering (Madsen, 2000). Techniques for rearing and releasing the weevil in lakes have been developed and under appropriate conditions, use of the weevil has produced good results in reducing Eurasian watermilfoil. A nine-year study of nine southeastern Wisconsin lakes suggested that weevil activity might have contributed to Eurasian watermilfoil declines in the lakes (Helsel et al, 1999).

Cost effectiveness and environmental safety are among the advantages to using the weevil rather than traditional herbicides in controlling Eurasian watermilfoil (Christina Brant, EnviroScience, personal communication). Cost advantages include the weevil's low maintenance and long-term effectiveness versus the annual application of an herbicide. In addition, use of the weevil does not have use restrictions that are required with some chemical herbicides. Use of the weevil has a few drawbacks. The most important one to note is that reductions in Eurasian watermilfoil are seen over the course of several years in contrast to the immediate response seen with traditional herbicides. Therefore, lake residents need to be patient. Additionally, the weevils require natural shorelines for over-wintering.

The Indiana Department of Natural Resources released *E. lecontei* weevils in three Indiana lakes to evaluate the effectiveness of utilizing the weevils to control Eurasian watermilfoil in Indiana lakes. The results of this study were inconclusive (Scribailo and Alix, 2003), and the IDNR considers the use of the weevils on Indiana lakes an unproven technique and only experimental (Rich, 2005). If future infestation of Eurasian watermilfoil should occur, Barbee Lakes residents should take the lack of proven usefulness in Indiana lakes into consideration before attempting treatment of the lake's Eurasian watermilfoil with the *E. lecontei* weevils.

9.7.2 Biological Control of Purple Loosestrife

Biological control may also be possible for inhibiting the growth and spread of the emergent purple loosestrife. Like Eurasian watermilfoil, purple loosestrife is an aggressive non-native species. Once purple loosestrife becomes established in an area, the species will readily spread and take over the shallow water and moist soil environment, excluding many of the native species which are more valuable to wildlife. Conventional control methods including mowing, herbicide applications, and prescribed burning have been unsuccessful in controlling purple loosestrife.

Some control has been achieved through the use of several insects. A pilot project in Ontario, Canada reported a decrease of 95% of the purple loosestrife population from the pretreatment population (Cornell Cooperative Extension, 1996). Four different insects were utilized to achieve this control. These insects have been identified as natural predators of purple loosestrife in its native habitat. Two of the insects specialize on the leaves, defoliating a plant (*Gallerucella californiensis* and *G. pusilla*), one specializes on the flower, while one eats the roots of the plant (*Hyllobius transversovittatus*). Insect releases in Indiana to date have had mixed results. After six years, the loosestrife of Fish Lake in LaPorte County is showing signs of deterioration.

Like biological control of Eurasian watermilfoil, use of purple loosestrife predators offers a cost-effective means for achieving long-term control of the plant. Complete eradication of the plant cannot be achieved through use of a biological control. Insect (predator) populations will follow the plant (prey) populations. As the population of the plant decreases, so will the population of the insect since their food source is decreasing.

9.8 Chemical Control

Herbicides are the most traditional means of controlling aquatic vegetation. Herbicides have been used in the past on the Barbee Lakes as detailed in previous sections. Additionally, it is likely that some residents may have conducted their own spot treatments around piers and swimming areas. It is important for residents to remember that any chemical herbicide treatment program should always be developed with the help of a certified applicator who is familiar with the water chemistry of the target lake. In addition, application of a chemical herbicide may require a permit from the IDNR, depending on the size and location of the treatment area. Information on permit requirements is available from the IDNR Division of Fish and Wildlife or conservation officers.

There are two major disadvantages associated with chemical control of aquatic plants. The primary concern associated with chemical use is user concerns regarding safety. Chemicals undergo rigorous testing prior to licensing. Testing is completed by the USEPA with the final registration occurring within each state. All herbicides are required to result in low toxicity to humans and wildlife and to not persist or bioaccumulate within the environment. Secondly, users are often concerned due to water use restriction. Restrictions must be posted prior to treatment and can be in the form of irrigation or full body contact. Finally, nutrient releases can occur due to the large volume of dying plant material. This disadvantage can be controlled through correct timing of aquatic plant treatment.

Herbicides vary in their specificity to given plants, method of application, residence time in the water, and the use restrictions for the water during and after treatments. Herbicides occur in two forms: contact and systemic. There are three primary contact herbicides used for controlling submerged aquatic vegetation: diquat (trade name Reward), endothall (trade name Aquathol K), and copper-based formulations (trade names Komeen, Clearigate, and Nautique). Contact herbicides are effective for controlling submerged vegetation on the short term. Such herbicides have historically lacked selectivity resulting in killing non-target plants and sometimes even fish species in a lake. However, recent research suggests that some contact herbicides can be effective for the control of exotic species with relatively minor effects on native species (Skogerboe and Getsinger, 2002). Additionally, it should be noted that the timing and dosage of contact herbicides can improve their selectivity and control, and that this control can be extended to attempt long-term control. Reward is the typical contact herbicide used for mid-season treatment. Diquat or copper-based contact herbicides are fast-acting and, based on this, these herbicides are typically used to control nuisance vegetation around docks or in high-use areas. However, plants can recover quickly from treatments of these herbicides; recovery can occur as quickly as four to eight weeks after treatment.

Research completed by Skogerboe and Getsinger (2002) indicate that treatment rates of endothall as low as 0.5 to 1.0 mg/L can effectively control curly-leaf pondweed and Eurasian watermilfoil. However, higher application rates (1.0 mg/L) of endothall provide better long-term control of curly-leaf pondweed and are required to sustain adequate chemical concentrations within large treatment areas (UPI, no date). Further research indicates that early spring application of endothall at a rate of 1.0 mg/L provides nearly 90% reduction in root biomass production and greater than 90% reduction in turion production (Poovey et al., 2002). (Poovey et al. (2002) defined early spring curly-leaf pondweed treatment as March or April when water temperatures are below 15 °C.) Furthermore, research indicates that late spring or early summer treatment after turions have formed is ineffective at long-term control of curly-leaf pondweed and that treatment methodology does not

reduce turion production. Aquathol K manufacturers recommend that treatment occur on or before temperatures reach 50 °F and suggest that early season treatment control “reduces turion production and may reduce the curly-leaf population over time” (UPI, no date). The following treatment rates are their recommendations for effective control of curly-leaf pondweed:

- Large treatment area: 1.0 mg/L (ppm) or 0.6 gallons/acre-foot
- Spot treatment: 1.5 mg/L (ppm) or 1.0 gallons/acre-foot

In the Barbee Lakes, treatment would likely occur along large areas and therefore could occur under the lower treatment rate (1.0 mg/L). However, given the Barbee Lakes’ depth and residence times and residents’ desire for long-term control, it is likely that the higher treatment rate (1.5 mg/L) will provide better long-term control. This translates to application of 0.6 gallons/acre in areas measuring 1 foot deep or less, application of 1.3 gallons/acre in areas 2 feet deep, application of 2.6 gallons/acre in areas 4 feet deep, and 3.8 gallons/acre in areas measuring 8 feet deep (UPI, 2007).

Systemic herbicides are those that work within the system of the plant itself. These herbicides are transported to the root system resulting in killing the entire plant. The three most common systemic herbicides used for the control of Eurasian watermilfoil are fluoridone (trade name Sonar or Avast!), 2,4-D (trade name Aqua-Kleen, DMA4, or Navigate), and triclopyr (trade name Renovate). (Additionally, imazapyr, glyphosate, and triclopyr can be used for the control of purple loosestrife.) Fluoridone is typically recommended for whole lake treatment of Eurasian watermilfoil and curly-leaf pondweed due to the lower tolerance of these species to fluoridone compared with other aquatic plant species. Smith (2002) noted control of Eurasian watermilfoil to the point of limited detectability following whole-lake treatment with fluoridone. Additionally, most Eurasian watermilfoil strains have a lower tolerance to fluoridone than most other aquatic plant species; therefore, if fluoridone is properly applied, control of Eurasian watermilfoil can occur with little harm to native species (AERF, 2005).

Triclopyr and 2,4-D are typically used for spot treatment of small areas of broad-leaf plants (dicots) like coontail, watermilfoil, and waterweed. Treatment with triclopyr is a good option if Eurasian watermilfoil populations are not dense or abundant. Treatment using triclopyr must be aggressive in order to result in adequate Eurasian watermilfoil control. Neither chemical affects monocots such as eel grass or pondweeds and are not effective in the control of curly-leaf pondweed. 2,4-D is a cheaper alternative than triclopyr; however, 2,4-D can impact other native species like coontail.

While providing a short-term fix to the nuisances caused by aquatic vegetation, chemical control is not a lake restoration technique. Herbicide and algaecide treatments do not address the reasons why there is an aquatic plant problem, and treatments need to be repeated each year to obtain the desired control. In addition, some studies have shown that long-term use of copper sulfate (algaecide) has negatively impacted some lake ecosystems. Such impacts include an increase in sediment toxicity, increased tolerance of some algae species, including some blue-green (nuisance) species, to copper sulfate, increased internal cycling of nutrients, and some negative impacts on fish and other members of the food chain (Hanson and Stefan, 1984 cited in Olem and Flock, 1990).

Chemical treatment should be used with caution on the Barbee Lakes since treated plants are often left to decay in the water. This will contribute nutrients to the lake’s water column. Additionally, plants left to decay in the water column will consume oxygen. Historic water quality sampling showed that the Barbee Lakes possessed relatively moderate to high nutrient concentrations

compared to many Indiana lakes (JFNew, 2000). Nonetheless, as evidenced during the plant survey, the lakes' total phosphorus concentration is high enough to support filamentous algae and, based on the water chemistry samples collected during the previous in-lake assessments, the lakes may also experience algal blooms. The plankton community present in the Barbee Lakes illustrates this issue in that the community is dominated by blue-green algae. Furthermore, the blue-green algae that comprised the largest portion of the plankton community have been known to cause taste, odor, and toxicity problems in other lakes. Chemical treatment is likely the best way to control growth and spread of Eurasian watermilfoil and curly-leaf pondweed in the Barbee Lakes. Herbicides (and algaecides; chara is an algae) that are non-specific or require whole lake applications to work are generally not recommended for treatment in the Barbee Lakes.

9.9 Preventive Measures

Preventive measures are necessary to curb the spread of nuisance aquatic vegetation. Although milfoil is thought to 'hitchhike' on the feet and feathers of waterfowl as they move from infected to uninfected waters, the greatest threat of spreading this invasive plant is humans. Plant fragments snag on boat motors and trailers as boats are hauled out of lakes (Figure 22). Milfoil, for example, can survive for up to a week in this state; it can then infect a milfoil-free lake when the boat and trailer are launched next. It is important to educate boaters to clean their boats and trailers of all plant fragments each time they retrieve them from a lake. The Stop Aquatic Hitchhikers! campaign offers information on the prevention of spreading exotic invasive species. Visit their website at for more information: www.protectyourwaters.net

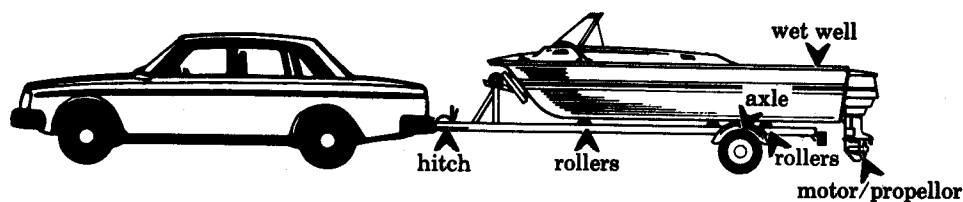


Figure 22. Locations where aquatic macrophytes are often found on boats and trailers.

Educational programs are effective ways to manage and prevent the spread of aquatic nuisance species (ANS) such as Eurasian watermilfoil, zebra mussels, and others. Of particular help are signs at boat launch ramps asking boaters to check their boats and trailers both before launching and after retrieval. All plants should be removed and disposed of in refuse containers where they cannot make their way back into the lake. The Illinois-Indiana Sea Grant Program has examples of boat ramp signs and other educational materials that can be used at the Barbee Lakes. Eurasian watermilfoil is present in the Barbee Lakes and other area lakes; therefore, educational programs and lake signage will help prevent the spread of this nuisance species into other parts of the lake or into other area lakes. This is particularly important given the popularity of the Barbee Lakes. Non-resident anglers and other visitors will use their boats in other lakes in addition to the Barbee Lakes, potentially spreading Eurasian watermilfoil to uninfested lakes. Signs addressing any best management practices to prevent the spread of nuisance aquatic species will ultimately help protect all lakes as new nuisance (often non-native) species are finding their way to Indiana lakes all the time. The IDNR can provide these signs in electronic format if the BLA wishes to handle printing and posting.

10.0 Public Involvement

The LARE biologist, district fisheries biologist, association representative, and a representative from the contracted herbicide applicator met October 24, 2007 to discuss the 2007 aquatic plant treatment and identify aquatic plant treatment options for 2008. From this meeting, it was determined that the following would occur:

1. All areas identified as possessing dense Eurasian watermilfoil beds should be treated in 2008.
2. Efforts to adequately catalog the curly-leaf pondweed community with early season surveys should also occur. These efforts should be followed by treatment of areas of high curly-leaf pondweed density.
3. High density native aquatic plant species should be considered for treatment. Native species treatment should occur in those areas where density impairs access or limits the recreation use or aesthetic enjoyment of the lake. Additionally, areas where these plants occur should also be maintained in their natural condition in order to balance environmental and recreational uses.

Based on this information, a grant application to treat both Eurasian watermilfoil and curly-leaf pondweed should be submitted to the LARE program staff. Although LARE aquatic plant treatment funds are limited, future efforts are targeted at accommodating early-season curly-leaf pondweed treatments and Eurasian watermilfoil treatment. Money may be available for treatment of these species; however, it may not be available to treat the entire acreage. Additionally, native plant treatment is not covered through the LARE program.

11.0 Public Education

It is imperative the lake users and residents participate and be informed as to the on-going efforts to protect and improve the Barbee Lakes. An annual meeting should be held to discuss the association's on-going efforts to control the spread of exotic species within the Barbee Lakes. At this time, an update of the past year's efforts should be discussed and the proposed treatment recommendations for the following year should be outlined. The October 6, 2007 meeting met these requirements for this year's planning efforts. Similar meetings should continue to be held. Additionally, information covering both of these topics should be included in the association's newsletter and signs should be posted warning users of the dangers of transporting aquatic plants, specifically exotic species.

Education efforts targeting information about Indiana's newest aquatic species of concern hydrilla, which was identified in Lake Manitou (Fulton County) in 2006. Hydrilla is an extremely aggressive submerged aquatic plant species that looks similar to common elodea. The basic difference is the number of leaves: hydrilla contains five leaves while common elodea only contains three leaves. Appendix E contains more detailed information on hydrilla, its habitat, and its distribution. Efforts to educate individuals on the control, spread, and issues associated with this and other exotic species should follow the Stop Aquatic Hitchhikers! Campaign which can be found at www.protectyourwaters.net. At a minimum, the BLA should post warnings and send information to Barbee Lakes' residents about this plant.

Finally, steps can be taken by individual property owners that will also help preserve and enhance the Barbee Lakes. The following is a list of potential actions that individuals can undertake:

1. Reduce the frequency and amount of fertilizer, herbicide, or pesticide used for lawn care.
2. Use only phosphorus-free fertilizer.
3. Consider re-landscaping lawn edges, particularly those along the watershed's lakes, to include low profile prairie species that are capable of filtering runoff water better than turf grass.
4. Consider resurfacing concrete or wooden seawalls with glacial stone, then planting native emergent vegetation along shorelines or in front of resurfaced or existing concrete or wooden seawalls to provide fish and invertebrate habitat and dampen wave energy.
5. Keep organic debris like lawn clipping, leaves, and animal waste out of the water.
6. Properly maintain septic systems. Systems should be pumped regularly and leach fields should be properly cared for.
7. Examine all drains that lead from roads, driveways, and rooftops to the watershed.
8. Obey speed limits through the lakes.
9. Thoroughly clean all material from boats and trailers after lake use and refrain from dumping bait buckets into the lake to prevent the spread of exotic species.

12.0 Integrated Management Action Strategy

The focus of the action strategy should be to meet the three goals identified earlier. These are as follows:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species.
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant, fish, and wildlife resources.

Each goal, along with objectives to meet this goal, is listed below. Following each objective are the actions which should be taken in order to achieve the objective.

12.1 Goal 1: Maintain a stable and diverse aquatic plant community.

The focus of the first goal is on the development and maintenance of a stable, diverse aquatic plant community. To meet this goal, the BLA should focus both on the emergent plant community and on the submerged plant community as both of these combine to create the aquatic plant community currently present within the Barbee Lakes.

Objective 1: Maintain and enhance the diversity of the rooted floating and emergent portions of the aquatic plant community.

Several isolated areas of rooted floating and emergent plant communities exist throughout the Barbee Lakes Chain. The lakes' rooted plant diversity and the areas of rooted and floating species should be protected and enhanced, if possible. The typical community displayed in Figure 23 details the density and diversity of emergent and rooted floating species that are present in the lakes chain. Overall, the lakes support excellent rooted plant diversity and this undoubtedly plays a role in supporting their healthy fishery. The density and diversity of the shallow water, emergent plant community prevents shoreline erosion and sediment resuspension; limits the ability for nuisance waterfowl to enter and exit the water onto the shoreline; provides habitat and cover for fish, amphibians, birds, and other wildlife; and filters nutrients that enter the lake from the lakeshore. Management techniques that are not species specific, such as contact herbicides, large scale harvesting, or dredging in bays, should be avoided to ensure the protection of the high quality community. Additionally, Barbee Lakes' residents may wish to consider re-establishing portions of the emergent plant community that previously existed in the lake. Additionally, restoration of eroding shorelines would also enhance the emergent and rooted floating plant community.



Figure 23. Typical emergent and rooted floating plant community present in the Barbee Lakes.

Barbee Lakes' residents should also take steps to restore the lakes' shoreline vegetation. Purple loosestrife and reed canary grass were identified in several locations along Barbee Lakes' lakeshore and in adjacent lawns (Figure 24). Both of these species are introduced from Eurasia and spread rapidly through prolific seed production, vegetative growth, and cultivation. Without individual control, both species can spread along the lakeshore inhibiting boat mooring and individual access to the lake. The LARE program does not typically provide funding for the control of either of these species due to budget constraints. Nonetheless, residents should become familiar with these plants and methods for their control. The two easiest ways to control the spread of both species is through hand pulling or digging and the application of herbicides. If hand digging is the selected method for removal, individuals should be sure to remove the entire root structure as purple loosestrife can re-sprout from the roots. The use of chemicals can limit regrowth. Any chemicals used to control these species must be approved for application near water, such as Rodeo. Removal of these species and restoration of the shoreline would return many of the functions provided by healthy riparian areas. Landowners should replace these plants with native species that provide equal or better quality aesthetics and are more useful to birds, butterflies, and other wildlife as habitat and a food source. Reed canary grass should be replaced with switch grass, Indian grass, or even big blue stem depending on the landowner's desired landscaping. Swamp blazing star, swamp milkweed, cardinal flower, blue-flag iris, or blue lobelia all offer more habitat and aesthetic variety than that offered by

purple loosestrife. A mixture of these species will also allow for colorful blooms throughout the growing season.



Figure 24. Typical pattern of purple loosestrife growth adjacent to the Barbee Lakes.

Objective 2: Maintain the density and diversity of the submerged portion of the aquatic plant community.

Overall, the Barbee Lakes' aquatic plant community is relatively diverse. The lakes' submerged community contained 21 and 25 species during the two aquatic plant surveys. The highest diversity was observed in Kuhn and Sechrist lakes, while Big Barbee, Sawmill, and Little Barbee lakes contained the lowest diversity. The high diversity observed in Kuhn and Sechrist lakes should be protected. In Big and Little Barbee and Sawmill lakes, the diversity is normal for area lakes and could be improved with improved water quality and control of exotic species. The variety of submerged plant species present in the Barbee Lakes provides fish cover and habitat for macroinvertebrates, amphibians, and reptiles; filters nutrients; and increases the aesthetic conditions present in the lake chain. Lake residents and users should become aware of the quality of their aquatic plant community and should limit the control or removal of the native populations of submerged aquatic plants. Native species should be controlled only in those locations where the density of aquatic plants limits the owner's aesthetic value or negatively impacts lake use. Control of native communities should be limited in shallow areas or around docks; treatment should only occur if there are difficulties in maneuvering boats to and from docks or other shoreline structures. Other specifics of native plant control are detailed below.

12.2 Goal 2: Reduce negative impacts from exotic and/or invasive species.

The focus of the second goal is on reducing the negative impacts from aquatic exotic or invasive species. This goal can be accomplished by reducing the density and coverage of current populations of exotic and/or invasive species and preventing the introduction of new species and the spread of current species to areas of the lake where exotic, invasive species are currently not present. Goal 2 builds on the objectives detailed in Goal 1 in that efforts to reach Goal 2 will assist the BLA in reaching Goal 1.

Objective 1: Reduce the density and abundance of Eurasian watermilfoil.

Eurasian watermilfoil is present in relatively high density throughout the Barbee Lakes. Eurasian watermilfoil is particularly a problem in Big and Little Barbee and Sawmill lakes and is located in isolated areas of Banning, Irish, Kuhn, and Sechrist lakes. Control of Eurasian watermilfoil in the Barbee Lakes Chain will continue to be a problem whether or not the BLA institutes control measures. This is due to three main reasons: 1) the popularity of the Barbee Lake suggests that reintroduction from off-shore users will continue without a strong educational program; 2) re-infestation from other areas within the Barbee Lakes Chain will continue to occur if all areas where Eurasian watermilfoil are present are not treated; and 3) control of all Eurasian watermilfoil upstream of the Barbee Lakes is necessary in order to remove the opportunity for reinfestation. If all three routes of introduction are not controlled, then Eurasian watermilfoil will continue to be a problem throughout the lakes chain. Nonetheless, in order to prevent the continued spread of Eurasian watermilfoil to other locations within the lake, a control program should be enacted. Eurasian watermilfoil reproduces through fragmentation and can rapidly spread to other areas of the lake and can reach nuisance levels. This species can displace native vegetation and has a tendency to form dense canopies that shade out native vegetation.

Ideally, elimination of Eurasian watermilfoil would be the goal for the Barbee Lakes. However, as described above, this objective is likely not attainable. Rather, a goal to reduce the overall frequency of Eurasian watermilfoil to occur at less than 5% of sites with dominance less than 1.0 throughout the lakes. During the current assessments, Eurasian watermilfoil, with a dominance of 1.82, occurred at 8.5% of sites during the summer survey. In order to control Eurasian watermilfoil within the Barbee Lakes, the use of 2,4-D (Navigate) or Renovate for spot treatment of populations is recommended. Up to 75 acres of Eurasian watermilfoil are recommended for treatment (Figure 25). The cost of this treatment is approximately \$28,125 if granular 2,4-D is used for treatment within the Barbee Lakes. The cost of this treatment is approximately \$34,500 if granular Renovate is used for treatment (Tony Cunningham, Weed Patrol, Inc., personal communication). Additional annual assessments and follow-up treatments will likely be necessary to control Eurasian watermilfoil populations within the Barbee Lakes. Barbee Lakes' residents should be aware that until all avenues of infestation are controlled, annual treatment of Eurasian watermilfoil will likely be required to reduce the spread of this species.

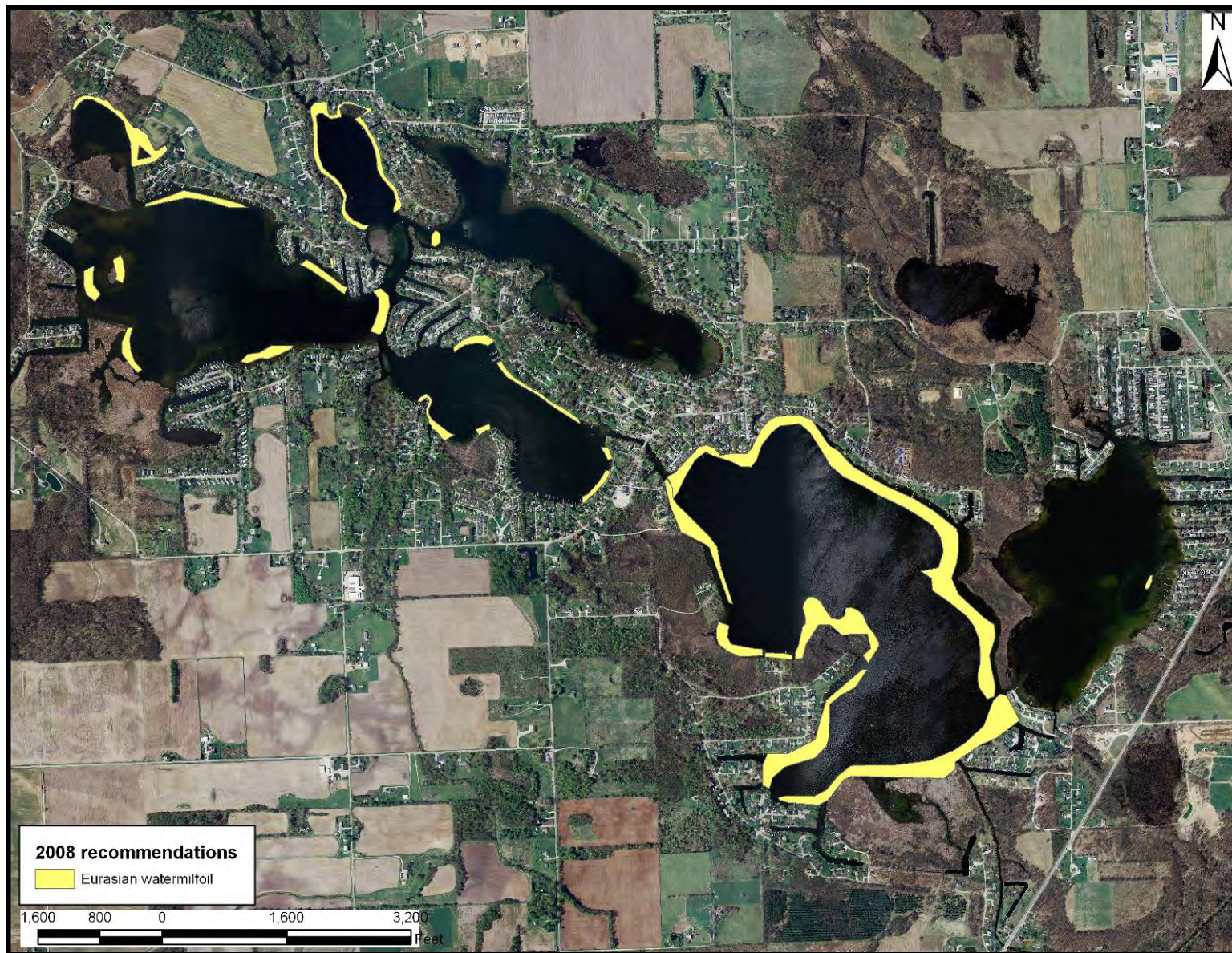


Figure 25. Eurasian watermilfoil population control recommendations for 2008.

In order to aid in the control of Eurasian watermilfoil, lake residents and users should be educated as to their impact on the spread of the plant. Eurasian watermilfoil spreads through fragmentation, which allows one small piece of Eurasian watermilfoil to colonize other areas of the lake. It is very important that boaters avoid driving through areas of the lake currently infested with Eurasian watermilfoil as this can chop the plant thereby creating fragments. These fragments can then be carried to other areas on boat propellers or float to other areas of the lake. It is also important the boaters remove all plant fragments from their boat propeller and trailer before traveling from lake to lake. If signs are currently not posted at the boat ramp detailing the need to clean boats and trailers, then signs should be posted warning boat owners and users to check their equipment for plant fragments.

Objective 2: Reduce the density and abundance of curly-leaf pondweed.

Treatment of curly-leaf pondweed through the LARE program has typically been limited to those lakes where infestations cover large percentages of the water's surface area. The Barbee Lakes Chain is one such chain of lakes where curly-leaf pondweed treatment is funded through the LARE program. Curly-leaf pondweed typically senesces during the height of the recreational season, which is one reason that treatment of this species is not always of high priority. However, curly-leaf pondweed can be a nuisance and control should be initiated as part of the long-term strategy to protect and improve the native submerged plant community. Curly-leaf pondweed is currently found throughout the lake's chain and is especially dense in Kuhn, Sechrist, Big Barbee and Sawmill lakes. In total, curly-leaf pondweed covers approximately 150 acres of the Barbee Lakes (Figure 26). Historically, curly-leaf pondweed covered nearly 150 acres of the Barbee Lake. As such, these areas likely contain resident turions which are present within the sediment covering this portion of the lake. Aquathol K is recommended for treatment of these areas and should continue to occur over several consecutive years to reduce the growth and production of turions, which can last for multiple seasons after treatment. Given the desire to ensure long-term control of curly-leaf pondweed and to reduce the production of turions, curly-leaf pondweed treatment should occur at a rate of 1 mg/L (0.6 gallons/acre in shallow water to 3.8 gallons/acre in deeper water) before water temperatures reach 50 °F. Estimates completed by Weed Patrol suggest that treatment of curly-leaf pondweed should continue to decline over time with an estimated treatment of 150 acres in 2008.

Like Eurasian watermilfoil, elimination of curly-leaf pondweed would ideally be the goal for the Barbee Lakes. However, as described above, this objective is likely not attainable. Rather, a goal to reduce the overall frequency of curly-leaf pondweed in the spring to occur at less than 10% of sites throughout the lakes in a dominance less than 5.0. During the current assessments, curly-leaf pondweed occurred at 27% of sites during the summer survey with a dominance of 7.6. In order to control curly-leaf pondweed within the Barbee Lakes, the use of endothall (Aquathol K) for spot treatment of populations is recommended. Up to 150 acres of curly-leaf pondweed are recommended for treatment (Figure 25). The cost of this treatment is approximately \$47,125 if Aquathol K at a dose of 1 mg/L is used for treatment within the Barbee Lakes. Additional annual assessments and follow-up treatments will likely be necessary to control curly-leaf populations within the Barbee Lakes. Barbee Lakes' residents should be aware that until all avenues of infestation are controlled, annual treatment of curly-leaf pondweed will likely be required to reduce the spread of this species.

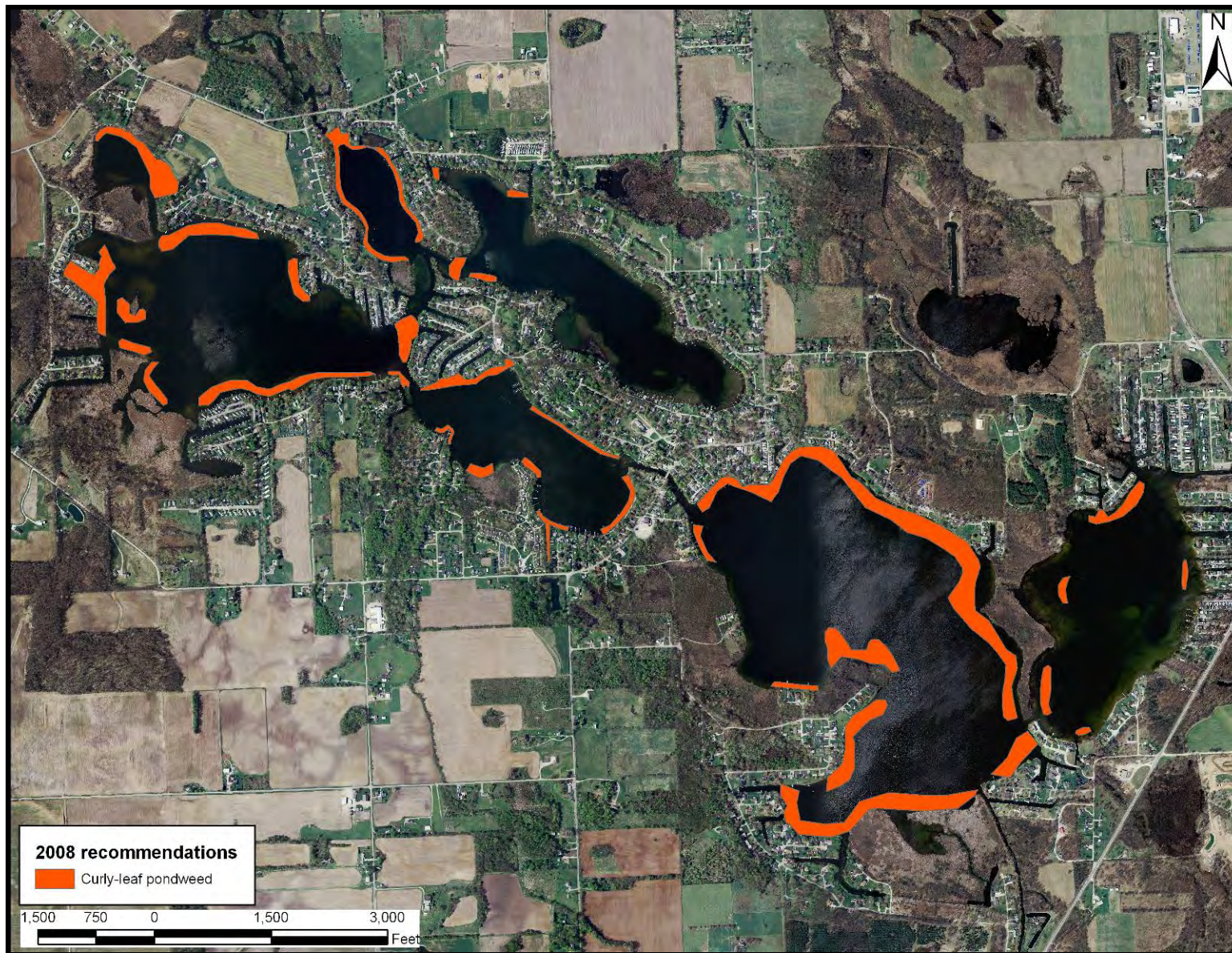


Figure 26. Curly-leaf pondweed population control recommendations for 2008.

Objective 3: Prevent the spread of purple loosestrife and reed canary grass.

Both purple loosestrife and reed canary grass can be detrimental to native shoreline and wetland species. Currently, control of these species is not funded through the LARE program. Nonetheless, if either of these species are present on an individual property, then the species should be removed through hand pulling and removal of the root structure. Removal should occur prior to the plants flowering.

Objective 4: Educate lake users and shoreline owners about the impacts of exotic and invasive species.

Currently, Indiana is home to four aquatic exotic, invasive plant species: Eurasian watermilfoil, curly-leaf pondweed, Brazilian elodea, and hydrilla. To date, Brazilian elodea and hydrilla are limited to one lake each: Brazilian elodea occurs in Griffy Lake in Bloomington, Indiana and hydrilla occurs in Lake Manitou in Rochester, Indiana. In order to prevent the spread of this and other exotic species, lake users should be educated regarding the potential impacts of these species and the threat of their spread. All three species spread by fragmentation allowing them to spread from one area to another within a lake and from lake to lake. Therefore, it is imperative that users remove all plant fragments from boats and trailers when entering and exiting lakes. Posting signs at the boat ramp will help reinforce this effort. The BLA should include information about hydrilla, Eurasian watermilfoil, and curly-leaf pondweed in their newsletters and on their website. Educational information about these and other exotic species can be found at the Stop Aquatic Hitchhikers! website (www.protectyourlake.net).

12.3 Goal 3: Provide reasonable recreational access while minimizing the negative impacts on plants, fish, and wildlife resources.

This goal focuses on the control of exotic species for recreational purposes; however, the control of a limited number of native species, including coontail, may also be necessary to meet reasonable recreational access goals. The Barbee Lakes are primarily recreation lakes where swimming, fishing, and pleasure boating are balanced with skiing, high speed boating, and the use of personal watercraft. In order to maintain aesthetic and ecological quality in the Barbee Lakes, it may be necessary to limit recreational uses.

Objective 1: Allow boat access through the control of aquatic vegetation around boat docks.

Native species proliferate in many areas of the Barbee Lakes. If allowed to continue to grow, these plants may begin to restrict shoreline owner access to the lake from their dock. In these areas, hand removal or spot chemical treatment of plants should be implemented. Up to 625 square feet of vegetation can be removed from an individual shoreline without a permit. Removal of native aquatic vegetation should be limited in the Barbee Lakes to only those areas where boat access is necessary. This typically measures 20 to 30 feet off of the shoreline. Native vegetation areas that remain shallow but occur outside this distance from the shoreline should be allowed to continue in their native form. Additionally, aquatic plants should not be treated farther than 100 feet from the lakeshore. No extraneous removal of aquatic vegetation is recommended at this time. If plants are removed from the lake by hand, they should not be left along the shoreline to desiccate. Rather, plants should be removed from the lakeshore and deposited in compost piles, gardens, or bagged for removal. If hand-pulling is not an option, residents should contact a certified aquatic applicator to implement treatment.

Objective 2: Control coontail population growth within Big Barbee, Little Barbee, and Sawmill lakes.

Coontail growth in Big Barbee, Little Barbee, and Sawmill lakes has reached nuisance levels. Areas where control should occur are limited to those locations where coontail limits individual's access

from their pier to the lake. Additionally, treatment should not occur along natural, undeveloped shorelines or in areas where boat access is not a high priority. The areas prioritized for treatment are displayed in Figure 27. However, it should be noted that this treatment should not occur until after other aquatic plant treatments have occurred. This will allow for the determination of whether areas mapped as nuisance in 2007 are still problem areas in 2008. It is estimated that 30 acres of coontail will be treated throughout these three lakes. The ideal goal for the Association is to maintain an aquatic plant community where coontail covers less than 50% of the sampled sites and occurs with dominance less than 25.0. However, for fish community management purposes, specifically management of muskie, coontail will likely need to account for 60-80% of the plant community.

Objective 2: Control eel grass population growth in Irish Lake.

Eel grass growth along much of Irish Lake's shoreline occurs in relatively high density. In areas of heavy boat traffic, eel grass populations should be controlled. Areas where control should occur are limited to those locations where recreational uses uproot eel grass causing eel grass to float throughout the lake. Additionally, treatment should not occur along natural, undeveloped shorelines or in areas where boat access is not a high priority. The areas prioritized for treatment are displayed in Figure 26. These areas were identified during aquatic plant surveys conducted with the lake association. However, it is very difficult to determine the exact locations where eel grass will be a problem year-to-year. For this reason, an assessment should be conducted after exotic species controls occur in order to determine the locations within Irish Lake where eel grass is again a problem. Furthermore, treatments should be targeted at locations where control will reduce fragmentation of this species that often results in floating mats of eel grass which travel throughout Irish Lake. It is estimated that 10 to 15 acres of eel grass will be treated within Irish Lake annually.

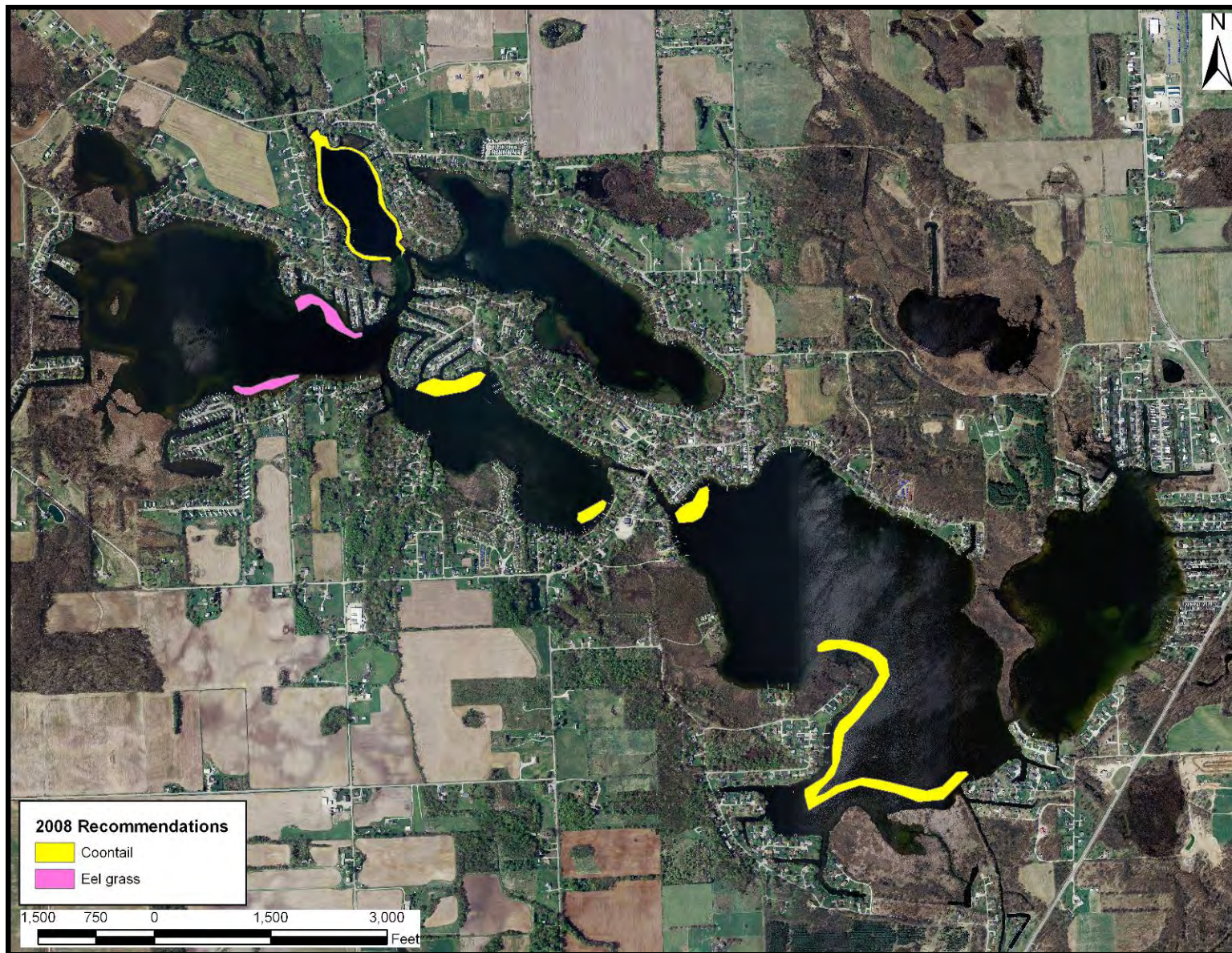


Figure 27. Priority areas of coontail and eel grass treatment in 2008.

12.4 Immediate Action Plan

The LARE Aquatic Plant Management Plan grant was provided to the Barbee Lakes Association for the purpose of funding aquatic vegetation controls on the lake. These controls should be approached using a three-prong effort: control of exotic species and nuisance native species; restoration or preservation of native plant communities; and education of lake users. Below, recommended actions are listed in order of importance. It should be noted that some of these actions may be funded through the LARE program; however, alternate sources of public or private monies may need to be obtained by the BLA in order to implement these actions.

1. Continue treatment of the Barbee Lakes' curly-leaf pondweed population with low-dose (1 mg/L) Aquathol K before water temperatures reach 50 °F. This treatment should be initiated within 150 acres of the lakes in 2008 and should continue throughout the five year planning period (2007-2011).
2. Continue spot treatment of up to 75 acres of Eurasian watermilfoil throughout the lakes. Areas to be treated are located along much of the developed shoreline of the lakes. Treatment should occur along only those areas where resident access is a priority. Additionally, treatment should be limited to 50 feet from shoreline, if possible but may extend to 100 feet from the shoreline.
3. Implement control of native species whose growth has reached nuisance levels. Specifically, control of eel grass within Irish Lake and coontail within Little Barbee, Big Barbee, and Sawmill lakes should be implemented. The exact acreage to be treated is not known at this time; however, it is estimated that control of eel grass will cover up to 15 acres while control of coontail will cover up to 30 acres.
4. Continue control of filamentous algae throughout the lakes and control of exotic species and filamentous algae within the channels around the Barbee Lakes.
5. Monitor the plant community using aquatic plant surveys for the next five years (2008-2012). These surveys should occur prior to treatment and following treatment to assess the effectiveness of controls and response of native plant community to these treatments. Surveys should include an assessment of the number of turions present in the substrate, if a method is developed and included in the IDNR monitoring program. In 2008, surveys should consist of a reconnaissance survey prior to treatment of either curly-leaf pondweed or Eurasian watermilfoil. A second, post-treatment reconnaissance survey and a Tier II survey should occur following treatment. Efforts should be made to align post-treatment survey dates with similar dates of surveys in the past. These surveys should be continued through 2012.
6. Post signs at all access sites in warning boaters of the potential for invasive plant species introductions from boat trailers. Signs should implore boaters to clean trailers, propellers and boats of all vegetative fragments when entering and leaving the Barbee Lakes. This is especially important given the high density of off-shore users that occur on the lake. Information concerning the potential spread of Eurasian watermilfoil and hydrilla should be distributed to all BLA members and lake users.
7. Investigate potential options to reduce nutrient and sediment loading to the lake through watershed management planning or implementation projects.
8. Remove purple loosestrife and reed canary grass from individual properties.
9. Maintain dock areas with physical plant removal when possible or by contracting professional applicators. Treatments should not exceed 100 feet from shoreline for submersed vegetation and treatment of rooted floating vegetation should be limited to boating lanes.
10. Educate lake users on best management practices in order to improve water quality.

13.0 Project Budget

Table 33 contains an **estimated** budget for the aquatic vegetation management action plan. The majority of the annual cost is associated with curly-leaf pondweed control costs, which are estimated to occur across the 145 acre area annually for five years. Each year's treatment should be reduced in acreage; however, given the likelihood of reinfestation and spreading of fragments within the lakes, this may not occur until later in the treatment cycle. Because the main treatment recommended in the Barbee Lakes consists of curly-leaf pondweed treatment with the idea of reducing the resident population over time, it is necessary for both pre-treatment and post-treatment reconnaissance and Tier II surveys to occur within the lakes. From these surveys, treatment and community distributions maps will be developed. It is our recommendation that the BLA requests \$91,250 from the LARE program. This budget includes the \$20,000 maximum per lake for in-lake treatment and \$16,000 for aquatic plant surveys and plan updates. All additional treatment of curly-leaf pondweed, Eurasian watermilfoil, coontail, eel grass, and/or algae must be funded through the lake association. A permit for this treatment is included in Appendix F. This permit should be submitted by the association and, once a contractor is selected for the treatment, the permit can be completed. It is possible that this project may not be fully-funded due to a recent hydrilla infestation in Lake Manitou that may use a large percentage of potential LARE funds.

Table 33. Budget estimate for the action plan, 2008-2012.

Task	2008	2009	2010	2011	2012
Curly-leaf pondweed treatment	\$47,125	\$42,250	\$3,900	\$3,550	\$3,550
Eurasian watermilfoil treatment	\$28,125	\$24,375	\$22,500	\$20,625	\$18,750
Plant sampling and plan update (including early-season assessment)	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000
Channel exotics and algae treatment	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
Native plant treatment	\$7,000	\$7,000	\$7,000	\$7,000	\$7,000
Algae treatment	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500
Total	\$126,750	\$118,125	\$77,900	\$75,675	\$73,800

Costs for aquatic plant assessment and treatment in 2008 are as follows:

- Eurasian watermilfoil treatment of approximately 75 acres with granular 2,4-D a cost of \$325 per acre for a total cost of \$28,125.
- Early season curly-leaf pondweed assessment and treatment. Assessment will include a Tier II survey prior to treatment and mapping of the curly-leaf pondweed community. Turion assessment should be included if a standard method for this type of assessment is developed. Treatment costs will depend upon the acreage identified for treatment. Based on previous years' treatments, it is anticipated that 145 acres of curly-leaf pondweed treatment with Aquathol K will be necessary. Aquathol K should be applied at a rate of 1.0 mg/L (0.6 to 3.8 gallons/acre). It is estimated that treatment of this acreage (300 acres) at this rate (1.0 mg/L) will cost approximately \$325/acre for a total cost of \$47,125
- Additionally, non-LARE funded treatment of algae throughout the lake and eel grass and coontail treatment of approximately 284 acres with contact herbicides is also recommended. Overall, these treatments are anticipated to cost \$35,500.
- Standard LARE assessment, public meeting, and plan update costs are based on 2007 LARE requirements (pre-treatment exotic species distribution survey; one post-treatment Tier II survey; public meeting; plan update). Additionally, a Tier II survey should be completed prior to curly-leaf

pondweed treatment occurs. Assessment of the Barbee Lakes plant community and plan update is anticipated to occur at a cost of \$16,000.

Total fees for 2008 aquatic plant assessment, herbicide application, and plan updated are estimated at \$126,750. LARE has historically provided funding of up to \$20,000 for aquatic plant treatment and provides monies for surveys and plan updates. All of these monies require a 10% match.

The following time schedule is anticipated for aquatic plant management activities for the Barbee Lakes in 2008:

March-April 2008	Curly-leaf pondweed assessment (Reconnaissance survey and mapping)
April-early May, 2008	Curly-leaf pondweed treatment
May 15-June 15, 2008	Eurasian watermilfoil and coontail treatment
July 15-August 30, 2008	Tier II and reconnaissance post-treatment assessment
August-September, 2008	Public meeting
November 2008	Meeting between IDNR LARE and fisheries staff, BLA, and contractor
December 15, 2008	Plan update and permit
January 15, 2009	LARE application for 2009 funding due

14.0 Monitoring and Plan Update Procedures

Monitoring shall follow procedures determined by the LARE program. Likewise, plan updates will conform to LARE requirements. Additional monitoring may occur outside of the LARE program. This could include, but is not limited to: early season assessment and treatment for curly-leaf pondweed (if not funded by LARE in the future), assessment and treatment of channel areas to limit Eurasian watermilfoil regrowth, and IDNR-based aquatic plant assessments. As these items are not part of the LARE program, their inclusion in any future LARE aquatic plant management plan updates is not required; however, their inclusion is suggested as a mechanism to contain all pertinent aquatic plant management information in one location and deal with changes in community and treatment requirements at one time even if all actions are not funded through the LARE program.

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APPENDIX A:

BARBEE LAKES USER SURVEY RESULTS

**BARBEE LAKES
AQUATIC PLANT MANAGEMENT PLAN REVISION 2007-2011**

Lake Use Survey Results: October 6, 2007
16 respondents

Lake name: Barbee Lakes Chain

Are you a lake property owner? Yes 94% No 6%

Are you currently a member of your lake association? Yes 88% No 6%

How many years have you been at the lake? <2 yrs 0% 2 – 5 yrs 6% 5-10 yrs 31%
> 10 years 63%

How do you use the lake (mark all that apply)

88% Swimming 13% Irrigation
100% Boating 6% Drinking water
88% Fishing 0% Other - Sailing, hunting, rest

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 88% No 12%

Do you currently participate in a weed control project on the lake? Yes 100% No 0%

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 94% No 6%

Does the level of vegetation in the lake affect your property values? Yes 81% No 0%

Are you in favor of continuing efforts to control vegetation on the lake? Yes 100% No 0%

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 81% No 6%

Mark any of these you think are problems on your lake:

19% Too many boats access the lake
63% Use of jet skis on the lake
6% Too much fishing
19% Fish population problem
75% Dredging needed
19% Overuse by nonresidents
75% Too many aquatic plants
0% Not enough aquatic plants
44% Poor water quality
6% Pier/funneling problem

APPENDIX B:
TIER II SURVEY RAW DATA
BARBEE LAKES
AQUATIC PLANT MANAGEMENT PLAN REVISION 2007-2011

Barbee Lakes spring Tier II survey raw data collected June 6 & 7, 2007.

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	MYREXA	MYRHET	MYRSP	NAIGUA	NTITELA	POTAMP	POTCRI	POTGRA	POTILL	POTNAT	POTNOD	STUPEC	POTRIC	POTZOS	UTRVUL	VALAME	X_COOR	Y_COOR
Banning	2		3	5																	1		605600.9836	4572851.192
Banning	3			5														1					605633.4098	4572934.166
Banning	3			5																			605520.0312	4573069.997
Banning	4			5					5									3					605719.2839	4572862.085
Banning	4		1	5					1														605622.3691	4572861.919
Banning	6	p							5														605606.9782	4572920.89
Banning	6	p		5			1	1	3												1		605474.379	4573075.379
Banning	6		1	5					5									1			1		605608.4033	4572883.108
Banning	7		5				1		5									1				1	605685.1734	4572908.838
Banning	7		3	5			1		1														605599.9694	4572945.02
Banning	8		5	1			3																605580.2814	4572973.888
Banning	8	p							1														605446.6524	4572989.179
Banning	9			1					5				1										605486.9984	4572928.395
Banning	10		1								5		1										605440.2917	4572947.564
Banning	10		1	1					1		5		1								1		605542.7552	4572916.181
Banning	11		1	1					1														605556.0471	4573018.986
Banning	11	p		1							1												605528.8726	4572920.515
Banning	12	p		1							1												605567.8368	4572933.171
Banning	12								1		1		1										605579.9154	4572906.132
Banning	13	p																					605564.8186	4572987.733
Banning	14																						605540.6299	4573021.47
Banning	14	p																					605493.6005	4573040.145
Banning	14	p											1										605518.1148	4573016.355
Banning	14	p	1								1												605484.6778	4572952.891
Banning	15																						605493.4622	4573020.028
Banning	15																						605500.1496	4572969.853
Banning	15																						605475.1044	4573014.222
Banning	15																						605513.9844	4572991.448
Banning	15																						605525.6951	4572952.971
Banning	16	p																					605454.2441	4573017.292
Big Barbee	2	p	5	3		1																	608697.5634	4570465.363
Big Barbee	3	p	5	1					3									1					608079.4751	4570931.799
Big Barbee	3	p		5					1				3							1		1	608270.2821	4570968.085
Big Barbee	3	p	3	5			1																608193.4851	4570350.519
Big Barbee	3	p		3																	1		609065.9166	4570700.326
Big Barbee	3	p		3																			609026.6984	4570828.442
Big Barbee	3	p	1	1																			609004.9064	4570928.786
Big Barbee	3	p	5		5				3														608978.0578	4571055.724
Big Barbee	3	p	5		1				5				1									3	608732.7073	4571475.903
Big Barbee	3	p	1		3				1														608343.511	4571751.363
Big Barbee	3	p			1				3									5					608169.1221	4571798.923
Big Barbee	4		5					1	1														607783.3521	4571551.54
Big Barbee	4	p			3			1	5				5								3		607882.8844	4571366.427
Big Barbee	4	p	3	1	5			1	1	1			1										607959.8881	4571186.095
Big Barbee	4	p	5	1	5			1	1	5			1							1		1	607952.1657	4570997.597
Big Barbee	4	p	1						3				1					1					608500.3263	4571023.547
Big Barbee	4	p	5						3				1										608337.4804	4570555.605
Big Barbee	4	p	5	1						1								1					608294.2039	4570354.198
Big Barbee	4	p	5	1					1				1										608496.4917	4570471.889
Big Barbee	4	p	3	1						1			1										608601.8861	4570489.235
Big Barbee	4	p	5	3						1													608840.5279	4570505.078
Big Barbee	4	p	3		3																1		609038.9361	4570619.478
Big Barbee	4	p	5						5				1									1	608865.368	4571291.92
Big Barbee	4	p	1							1								1				1	608843.1396	4571376.416
Big Barbee	4	p		1						1													608584.2157	4571572.721
Big Barbee	4	p							5														608051.8059	4571664.697
Big Barbee	4	p	3	3	5				3												1		608689.5029	4571514.735
Big Barbee	5	p	1		5		1		1				1					1		1			608276.2621	4571029.782
Big Barbee	5	p	5	1	1					1			1										608141.5532	4570454.173
Big Barbee	5	p	5	1	1																		608361.6328	4570377.862
Big Barbee	5	p	3		5				3														608914.9539	4570567.062
Big Barbee	5	p							1	3													608844.1664	4571181.882
Big Barbee	5	p	1	5	3				1														608454.4858	4571624.534

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	MYREXA	MYRHET	MYRSP1	NAJGUA	NITELLA	POTAMP	POTCRI	POTGRA	POTILL	POTINAT	POTNOD	STUPEC	POTRIC	POTZOS	UTRVUL	VALAME	X COOR	Y COOR
Big Barbee	6	p	5		1				1														607840.8966	4571396.466
Big Barbee	6	p	5		3				3									1				1	608194.6808	4570933.39
Big Barbee	6	p	5	1						1			1										608242.0814	4570514.085
Big Barbee	6	p	3		1					1			1										608988.0569	4570852.826
Big Barbee	6	p			5				5														608910.0855	4571107.432
Big Barbee	7	p	5	1	3				5											1			608340.5105	4571068.472
Big Barbee	7	p	5		1				5	1													608381.5698	4571055.705
Big Barbee	7	p	5	1																			608369.7404	4570648.976
Big Barbee	7	p	3						5				1										608949.7199	4571043.829
Big Barbee	7	p	1		1				1				1										608329.7713	4571696.404
Big Barbee	8	p	5																				607784.6604	4571489.727
Big Barbee	8		5						1				1										607783.393	4571483.677
Big Barbee	8	p	5	1	3				5	1													607975.6152	4571002.549
Big Barbee	8		1																				608435.1804	4570791.087
Big Barbee	8	p	5										3										608437.1222	4570469.093
Big Barbee	8		3		1		1		1														608710.9909	4570509.484
Big Barbee	9	p	1						3														609010.761	4570687.475
Big Barbee	9	p	5																				608485.1359	4571571.689
Big Barbee	9		3		1																		608119.4476	4571696.404
Big Barbee	10	p	3				1																608391.3849	4570734.817
Big Barbee	10	p	5		1				5	1			1										608786.6244	4571311.33
Big Barbee	10	p	3						1														608246.2759	4571761.932
Big Barbee	11		3																				608518.5378	4570873.081
Big Barbee	11		5																				608364.968	4570565.071
Big Barbee	11		3																				608173.3303	4570452.947
Big Barbee	12		1																				608877.2762	4570578.137
Big Barbee	12	p	5																				608955.979	4570997.48
Big Barbee	13		5																				607999.4766	4570953.305
Big Barbee	13	p	3						5				1										608413.1257	4571070.26
Big Barbee	13		5																				608774.9026	4571383.468
Big Barbee	13		3																				608749.4979	4571242.114
Big Barbee	14	p	1																				607973.3749	4571245.965
Big Barbee	14		1																				608242.1205	4570424.727
Big Barbee	15	p																					607958.7969	4571347.765
Big Barbee	17	p	3																				608570.1995	4570953.422
Irish	2.5	p																			1		606453.8736	4572345.136
Irish	3	p	1															1					606063.3519	4572033.813
Irish	3	p	1																		3		606515.6798	4572136.478
Irish	3	p		3						1												1	606519.2147	4572279.886
Irish	3	p							5				1									3	605943.8615	4572666.594
Irish	3		5				3		5													1	605872.6206	4572684.676
Irish	3	p		5				1	1									1					605559.5885	4572608.589
Irish	3	p		5					1									1				1	605510.8504	4572605.219
Irish	3								1														605430.7256	4572499.111
Irish	3	p																					605947.734	4572118.112
Irish	3	p																					606673.8637	4572397.978
Irish	4	p	1	1																	1		606213.8499	4572098.607
Irish	4	p											1							3		3	606297.2866	4572126.548
Irish	4	p	1	1																			606600.8664	4572148.649
Irish	4		5	1					1	1												1	606627.7343	4572217.074
Irish	4	p	1	1	1																		606639.9771	4572277.045
Irish	4	p		3						1								1					606409.0764	4572380.311
Irish	4	p																			3		606191.3015	4572487.769
Irish	4	p		5											1			3				1	606181.3693	4572609.043
Irish	4			3			1																605616.0372	4572577.273
Irish	4	p		5					1				1				3	1					605439.0402	4572318.804
Irish	4			1													1						605519.0775	4572233.165
Irish	4			1					3								1				1		605606.0305	4572209.291
Irish	4			3					1	1							1						605623.476	4572148.929
Irish	4		1	1																			605784.1802	4572012.377
Irish	4		1	3					1								1						605870.8596	4572029.511
Irish	4.5		1	3														1					606119.6794	4572065.496
Irish	5		5																				606415.8588	4572130.293
Irish	5	p	1	1				1													1		606329.6288	4572447.511

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	MYREXA	MYRHET	MYRSP1	NAJGUA	NITELLA	POTAMP	POTCRI	POTGRA	POTILL	POTNAT	POTNOD	STUPEC	POTRIC	POTZOS	UTRVUL	VALAME	X COOR	Y COOR
Irish	5	p		1					1													1	605681.8236	4572623.833
Irish	5			3													3						605459.1533	4572271.685
Irish	6	p							3														606567.8996	4572245.814
Irish	6	p							1	1		1	1					1					606216.6788	4572377.263
Irish	6						1	1	1							1				1		1	606132.5526	4572385.632
Irish	6	p								1												3	606168.6963	4572442.232
Irish	6			3																			605749.2525	4572668.015
Irish	6			3	1												1					1	605679.7188	4572049.441
Irish	6			3	3																		605707.9466	4572023.877
Irish	7	p		1					3				1									3	606329.3998	4572392.602
Irish	7			5		1											1	1				1	605618.1764	4572503.321
Irish	7			1	1			1	5														605445.6393	4572611.337
Irish	7	p		3	3				5													1	605448.6504	4572554.164
Irish	7	p		3	5				3														605472.3934	4572427.689
Irish	7			3					1				1				3					1	605534.8737	4572309.501
Irish	8			5			3	1	1														606063.0144	4572646.26
Irish	8			1					5														605658.7575	4572214.267
Irish	8	p																					605877.3924	4572092.627
Irish	9			3	3	1		3		1		1	1							1			606145.8428	4572539.588
Irish	10			3																			606172.4032	4572159.427
Irish	10			3					3														605656.131	4572123.51
Kuhn	2	p																				1	609101.7098	4570816.47
Kuhn	2			3												1							609522.3272	4571039.407
Kuhn	3							5		1			1			1				5		1	609116.0655	4570984.243
Kuhn	3			5				1						1		1							609198.6638	4571123.856
Kuhn	3			5												1					1		609106.1045	4571260.369
Kuhn	3			1				1								1							609687.3847	4571486.091
Kuhn	3				1			3															609687.145	4571211.1
Kuhn	3							1	5				3		1				3				609615.4738	4571279.303
Kuhn	3							1					1						5				609543.0536	4571232.233
Kuhn	3			3										1							1		609516.9779	4571140.287
Kuhn	3			3																			609364.5898	4570803.706
Kuhn	4							5				1	1										609128.4297	4570871.543
Kuhn	4			1				5								1				1		1	609150.0157	4571227.091
Kuhn	4			1				5								1						1	609212.0353	4571407.336
Kuhn	4	p		1				3													1	1	609344.3268	4571565.312
Kuhn	4			3				1								1							609624.7133	4571649.576
Kuhn	4				3			5													1		609592.6453	4571558.461
Kuhn	4							5				1									1		609705.1252	4571355.475
Kuhn	4			1				5						1	1						1		609466.9931	4571102.485
Kuhn	4							5														1	609428.978	4570962.916
Kuhn	5			1				5					1						1	1		1	609645.4235	4571370.595
Kuhn	5							1							1								609651.5067	4571222.807
Kuhn	5							5											1	1		1	609266.5515	4571098.167
Kuhn	6			1				5					1	1									609154.2169	4571367.197
Kuhn	6				5			5	1				1		5							1	609461.6264	4571599.378
Kuhn	6							3					1						3			1	609555.4929	4571097.247
Kuhn	6							5					1	1					3	1	1		609425.3252	4571005.664
Kuhn	7			1				5							1							1	609288.6487	4571540.947
Kuhn	7			1				5														1	609541.3864	4571690.046
Kuhn	7				1			1					1		3								609513.7502	4571546.48
Kuhn	7												3						5				609609.4857	4571486.725
Kuhn	7							3					3									1	609377.8647	4571249.644
Kuhn	8			1									1						3				609440.5048	4571261.484
Kuhn	8							3					1		1				3				609241.0833	4571212.546
Kuhn	8							3					1						5				609353.2305	4571072.92
Kuhn	9							1											3			1	609346.2968	4571186.421
Kuhn	9							5				1	3										609292.4611	4570795.886
Kuhn	10							1			5		5										609260.1792	4571486.01
Kuhn	10							1		1		1											609380.2488	4570923.385
Kuhn	11							3			1		3	1	1								609153.8558	4571289.402
Kuhn	11							1					1	1							3		609258.5689	4570733.394
Kuhn	15			1							5		1		1								609408.5583	4571497.543
Kuhn	15																						609198.7178	4570817.133

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	MYREXA	MYRHET	MYRSPI	NAJGUA	NITELLA	POTAMP	POTCRI	POTGRA	POTILL	POTINAT	POTNOD	STUPEC	POTRIC	POTZOS	UTRVUL	VALAME	X COOR	Y COOR
Kuhn	17										1												609439.6954	4571496.147
Kuhn	17										1												609587.4933	4571437.556
Kuhn	18										1												609312.5293	4570877.829
Kuhn	19										1												609219.0821	4571301.586
Kuhn	19										1												609335.1936	4571478.843
Kuhn	20	p																					609183.6264	4570931.228
Kuhn	20																						609241.8018	4570789.893
Little Barbee	2	p			3																		607477.4701	4571730.156
Little Barbee	2.5	p	5	3	3				1														606957.2878	4571758.149
Little Barbee	3	p	5															1					606842.2515	4571787.748
Little Barbee	3	p	5														1					1	606923.8911	4572121.254
Little Barbee	3	p	5						5									3				1	606814.9271	4572110.981
Little Barbee	4	p	1																				606720.2697	4572072.287
Little Barbee	4	p	5						3									1					606972.999	4571782.136
Little Barbee	4	p	5		1				5														607464.5646	4571597.402
Little Barbee	4	p	5	1	1				1									1					607377.8875	4571813.585
Little Barbee	4	p	5						5														607039.0438	4572102.567
Little Barbee	4	p	5	1																			607005.6195	4572139.409
Little Barbee	4	p	1						1									3					606890.8828	4572102.137
Little Barbee	5	p	5		1				5														607090.6655	4571798.067
Little Barbee	5	p	5		5				5				1									1	607167.4763	4571952.266
Little Barbee	6		5		1				5														606809.7903	4571834.164
Little Barbee	6		5	1	1				5														607141.9245	4571650.137
Little Barbee	6		5						3														607296.4653	4571859.598
Little Barbee	6	p	5		3				5											1		1	607045.735	4572059.528
Little Barbee	7	p	1																				606690.2665	4572052.779
Little Barbee	7		5																				606667.5701	4571999.542
Little Barbee	7	p	5		1				3														606727.8552	4571927.973
Little Barbee	7	p	5						1														606916.9632	4571766.759
Little Barbee	7		5	3					1				1										607158.026	4571613.691
Little Barbee	7	p	5		1				5														607218.1835	4571919.359
Little Barbee	8		5																				607064.9658	4571823.586
Little Barbee	8		1																				607160.9461	4571718.426
Little Barbee	8	p	5						5														607081.7405	4572001.737
Little Barbee	9		5																				607143.0144	4571774.63
Little Barbee	9	p	5						1														607473.2842	4571645.853
Little Barbee	10	p	1	1	1				1														607414.0525	4571757.54
Little Barbee	11	p	1						1														607184.0741	4571576.101
Little Barbee	11		3						1														607350.5859	4571530.846
Little Barbee	12		3																				606691.8249	4571974.344
Little Barbee	13		5																				607385.0086	4571541.168
Little Barbee	14																						606806.7785	4571918.265
Little Barbee	14																						606974.8526	4571831.999
Little Barbee	14																			1			607261.8978	4571566.182
Little Barbee	14	p											1										607427.7699	4571612.321
Little Barbee	14		1																				606969.1412	4572103.048
Little Barbee	14	p	1						1														606817.3556	4572072.555
Little Barbee	16																						607358.9159	4571564.901
Sawmill	3	p	1																				606664.8621	4572598.43
Sawmill	3	p	5		1				5				1					1					606488.6178	4572693.311
Sawmill	3	p	5										1										606395.7764	4572805.994
Sawmill	3	p	5	1	3				5				1										606340.6692	4573068.424
Sawmill	3	p	1	3					1				1										606381.7045	4573052.125
Sawmill	3	p	3	1					3				1										606549.0504	4572967.592
Sawmill	3	p	1	1						3							1						606670.9804	4572670.155
Sawmill	4	p	1						1														606578.8881	4572611.093
Sawmill	4	p	3						3				1										606474.4372	4572652.28
Sawmill	4	p	5		5								1										606375.1165	4572825.588
Sawmill	4	p	3	1					5								1						606395.4797	4573021.311
Sawmill	4	p	5	1	1					1			1										606604.4875	4572806.875
Sawmill	4	p	1						1														606632.7403	4572753.248
Sawmill	4	p		1																			606628.5676	4572595.665
Sawmill	5	p	5	1					3														606515.0729	4572601.05
Sawmill	5	p	1						5														606360.4716	4573024.155

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	MYREXA	MYRHET	MYRSP	NAJGUA	NITELLA	POTAMP	POTCRI	POTGRA	POTILL	POTINAT	POTNOD	STUPEC	POTRIC	POTZOS	UTRVUL	VALAME	X_COOR	Y_COOR
Sawmill	6		5						3														606471.2315	4572738.379
Sawmill	6		5										1										606369.4475	4572865.655
Sawmill	6	p																					606642.3134	4572645.735
Sawmill	7	p	5	1					5				1										606436.8024	4572770.236
Sawmill	7	p	5		1								1										606373.0771	4572844.52
Sawmill	7	p	5						1	1			1										606364.728	4572989.148
Sawmill	7		5																				606546.5573	4572944.53
Sawmill	7	p	3																				606592.5583	4572841.919
Sawmill	7	p	5						5	1													606650.1356	4572698.597
Sawmill	8	p	5						3				1										606499.8433	4572665.059
Sawmill	8		3						5				1										606369.1258	4572950.525
Sawmill	8	p	5	1	1				5	1			1					1					606504.7867	4573001.083
Sawmill	8	p	3																				606519.9323	4572971.717
Sawmill	8		1																				606582.8428	4572881.235
Sawmill	8	p																					606591.1996	4572632.92
Sawmill	9		3						1				1										606366.9348	4572925.915
Sawmill	11		3										1										606369.8503	4572901.473
Sawmill	11		3						1				1										606384.68	4572995.152
Sawmill	11	p																					606444.3297	4573007.727
Sawmill	12		3																				606557.189	4572937.185
Sawmill	13	p	1						3														606375.4	4572968.646
Sawmill	13		5																				606404.7757	4572991.179
Sawmill	13	p	3																				606553.0741	4572626.227
Sawmill	14	p	1																				606486.4691	4572982.096
Sawmill	16	p																					606482.8427	4572984.163
Sechrist	2			5																		1	607577.6664	4572463.354
Sechrist	3																1					5	607301.8631	4572358.216
Sechrist	3	p		3																		1	607373.2263	4572260.893
Sechrist	3			3								1	1	1	1								607703.9825	4572066.23
Sechrist	3			1				3						1	1		1					3	607418.9215	4572584.097
Sechrist	3			5								1			1							1	607118.6476	4572662.907
Sechrist	4	p		3								1	1					1					606850.097	4572515.875
Sechrist	4							5									1					1	607897.6003	4572126.129
Sechrist	4			1				3									1					1	607645.6771	4572325.312
Sechrist	4							1					1									3	607039.6959	4572845.666
Sechrist	5			1								1										1	606826.7415	4572864.374
Sechrist	6		1	1					1														607457.8711	4572187.228
Sechrist	6							5									3			1		1	607864.7248	4572040.904
Sechrist	7							1					5		1								606924.8352	4572522.884
Sechrist	7							5														1	607595.9113	4572432.256
Sechrist	7			1				1														1	607303.686	4572643.699
Sechrist	7			1						1												1	606921.653	4572750.798
Sechrist	8							5				1	1										607176.1493	4572465.354
Sechrist	8			1				1		1			1				1					1	607617.0195	4572058.948
Sechrist	8		5					1		1							1					1	607611.9535	4572322.387
Sechrist	8							3														1	606891.1071	4572818.605
Sechrist	9						5	5				3				1							607702.9398	4572110.005
Sechrist	9			3				5														3	607503.1878	4572497.592
Sechrist	9	p		1				3									1	1				3	607413.6907	4572567.328
Sechrist	10		1										1									3	607206.0983	4572461.903
Sechrist	10			1						1			1										606871.492	4572857.099
Sechrist	11																						607074.407	4572650.289
Sechrist	11							1					1									5	607087.9016	4572806.971
Sechrist	12										1		1										607794.1206	4572049.442
Sechrist	12														1					1		1	607668.4989	4572261.403
Sechrist	12			1				1					1		1		1					5	607233.7732	4572669.61
Sechrist	13		1																				607299.5499	4572424.426
Sechrist	13		3					3	3				1									1	607377.6993	4572304.003
Sechrist	13	p																					607476.2492	4572125.834
Sechrist	14																						606971.2373	4572518.661
Sechrist	14		1																				606901.7192	4572837.496
Sechrist	15	p									3		3							1			606895.1358	4572542.761
Sechrist	16		1																				606934.7119	4572875.676
Sechrist	16		5					1															606986.712	4572853.423

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	MYREXA	MYRHET	MYRSPI	NAJGUA	NITELLA	POTAMP	POTCRI	POTGRA	POTILL	POTNAT	POTNOD	STUPEC	POTRIC	POTZOS	UTRVUL	VALAME	X_COOR	Y_COOR
Sechrist	17		1					1					3	1						1		3	607819.0177	4572218.516
Sechrist	18		1					1													1		607100.7555	4572464.352
Sechrist	18	p	1																				607854.1357	4572074.857
Sechrist	18		3																				606949.1921	4572669.814
Sechrist	19	p	1								1												607527.6196	4572096.11
Sechrist	19										1												606939.3534	4572628.019
Sechrist	20							3				1	5								1		607027.605	4572498.027
Sechrist	20																						607745.6756	4572230.729
Sechrist	20																						606914.2354	4572844.932
Sechrist	24																						607347.757	4572385.383
Sechrist	24	p																					607828.1943	4572106.036

Barbee Lakes summer Tier II survey raw data collected August 8 & 24, 2007.

LAKE	DEPTH	FLALG	CERDEM	CHARA	ELOCAN	ELONUT	HIEDUB	MYREXA	MYRHIET	MYRSP1	NAJFLE	NAJGUA	NTIELLA	POTAMP	POTBER	POTFOL	POTFRE	POTGRA	POTILL	POTNOD	POTPEC	POTPRE	POTRIC	POTZOS	UTRVUL	VALAME	X COOR	Y COOR
Banning	3			5																							605636.7749	4572921.034
Banning	3	p	3	5								1															605427.5775	4572952.213
Banning	4	p	1	3																							605688.6356	4572902.468
Banning	4	p	1	5								1											1				605510.188	4572879.812
Banning	5			1																		1					605625.657	4572870.609
Banning	5		5																								605483.4626	4573067.877
Banning	5	p		3																		3			3		605539.9802	4572886.932
Banning	5	p	3	1					1															1			605605.1192	4572883.122
Banning	7			3																							605705.2282	4572861.963
Banning	7	p																									605501.126	4573031.727
Banning	7	p	3										1														605465.985	4572937.335
Banning	8	p	1	3					1															1			605607.1266	4572913.402
Banning	8	p	3										1														605514.3875	4573051.372
Banning	9																										605450.7126	4573016.473
Banning	9																										605461.9016	4572967.375
Banning	10		1																								605568.7023	4572920.864
Banning	11								1																		605592.0955	4572945.006
Banning	12																										605547.97	4573018.33
Banning	13		3										3														605580.3829	4572967.096
Banning	14	p																									605563.288	4572978.196
Banning	14																										605531.8934	4573010.226
Banning	14																										605541.6484	4572935.978
Banning	14																										605557.8303	4572944.882
Banning	15																										605480.4359	4573000.583
Banning	15																										605510.812	4572941.318
Banning	16	p																									605483.7074	4573027.231
Banning	16																										605502.9362	4572993.563
Banning	16																										605506.282	4572978.692
Banning	16																										605540.2714	4572966.821
Big Barbee	2	p	1																								608180.6114	4570364.958
Big Barbee	2	p	1																			1					608706.9396	4570461.958
Big Barbee	2	p	3		5																						608872.5958	4571389.451
Big Barbee	3	p	3																						1		607888.834	4571352.663
Big Barbee	3	p	5		5																		1				608169.4461	4570936.726
Big Barbee	3	p	3																								608348.8375	4571047.416
Big Barbee	3	p	5																								608190.7713	4570502.772
Big Barbee	3	p	1																								608599.1161	4570477.773
Big Barbee	3	p	1																								608840.302	4570502.545
Big Barbee	3	p	1																								609041.5432	4570691.654
Big Barbee	3	p	1		1							1													1		609009.3183	4570818.042
Big Barbee	3	p	5		3																						608952.236	4571086.152
Big Barbee	3	p	5																								608916.362	4571280.131
Big Barbee	4		5																								607951.1272	4571000.185
Big Barbee	4		5									1															608054.2035	4570927.037
Big Barbee	4									1		3															608472.7015	4571062.018
Big Barbee	4		5																								608520.2708	4571032.471
Big Barbee	4	p	5																								608342.7438	4570557.786
Big Barbee	4	p	3																								608136.0661	4570480.166
Big Barbee	4	p	5																								608265.5143	4570349.44
Big Barbee	4	p	1																								608542.478	4570475.165
Big Barbee	4			3																							609022.5241	4571047.089
Big Barbee	4	p																							1		608735.2577	4571445.665
Big Barbee	4	p	1		3																						608676.5427	4571499.105
Big Barbee	4	p	1									1															608604.6368	4571550.351
Big Barbee	4	p	5		1																	1				3	608300.307	4571775.999
Big Barbee	5	p																				1					607771.3468	4571554.3
Big Barbee	5		5																								607982.6501	4571176.929
Big Barbee	5		5																								608497.204	4570842.87
Big Barbee	5		1																								608439.4837	4570771.699
Big Barbee	5	p	3									1															608362.6989	4570394.047
Big Barbee	5	p	1																								608431.4406	4570472.387
Big Barbee	5		1																						1		608974.3831	4570582.684
Big Barbee	5	p	5		3							1					1				1						608978.2317	4570921.976
Big Barbee	5		5																								608822.5914	4571148.695
Big Barbee	5	p	3																						1		608431.2987	4571640.576
Big Barbee	5		3																						1		608142.1838	4571758.14
Big Barbee	5		5																								608073.567	4571626.173
Big Barbee	5	p	1									1															607824.5063	4571625.701
Big Barbee	6		5																								607786.5443	4571496.405
Big Barbee	6	p	5																								608269.0045	4571040.449
Big Barbee	6	p	5							1													1				608332.5991	4570526.452
Big Barbee	6	p	5																								608153.7801	4570419.784
Big Barbee	6	p	1																								608682.6624	4570485.2
Big Barbee	6		5		1							1														1	608902.3081	4570553.216
Big Barbee	6	p																									608964.8704	4570837.211

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	HETDUB	MYREXA	MYRHET	MYRSP1	NAJFLE	NAJGUA	NITELLA	POTAMP	POTBER	POTFOL	POTFRE	POTGRA	POTILL	POTNOD	POTPEC	POTPRA	POTRIC	POTZOS	UTRVUL	VALAME	X_COOR	Y_COOR		
Big Barbee	6		5	1	3						1																608352.9337	4571709.688		
Big Barbee	7	p	3																								608022.1221	4570978.886		
Big Barbee	7		5																								608228.9071	4570992.231		
Big Barbee	7		5																								608978.7354	4570661.856		
Big Barbee	7		5																								608934.94	4571050.575		
Big Barbee	7	p	3																								607883.9132	4571694.052		
Big Barbee	8		5																								607897.6494	4571366.056		
Big Barbee	8		5																								608403.1299	4571059.012		
Big Barbee	8	p	5																								608271.0966	4570501.768		
Big Barbee	8	p	5		1																						608251.2998	4570387.418		
Big Barbee	8	p	5		1	1				1																	608765.7601	4571417.957		
Big Barbee	8		5																								608503.6686	4571567.294		
Big Barbee	9	p																									607990.5499	4571219.888		
Big Barbee	9	p	3																								608573.3317	4570942.983		
Big Barbee	10	p	1																								608402.1625	4570622.85		
Big Barbee	10	p																									608727.9685	4571191.771		
Big Barbee	11		1																								607957.1917	4571300.313		
Big Barbee	11	p																									608430.6091	4570711.635		
Big Barbee	12	p	3																								608288.2437	4570403.676		
Big Barbee	12		5																								608482.3143	4570505.617		
Big Barbee	12		5																								608953.8703	4570997.525		
Big Barbee	12	p	3																								608245.7047	4571755.155		
Big Barbee	13		1																								608891.9466	4570600.857		
Big Barbee	14	p									1																608054.3619	4570961.906		
Big Barbee	15																										608715.5828	4571352.431		
Big Barbee	15																										608531.6763	4571523.105		
Big Barbee	15	p	1																								607855.3788	4571573.28		
Irish	2	p	1																							3	606303.7256	4572131.12		
Irish	2	p									1																1	606599.2266	4572140.445	
Irish	2			5																								605662.9054	4572066.42	
Irish	3		3														1				1					1	606138.4422	4572078.979		
Irish	3																				1						5	606216.9467	4572115.259	
Irish	3	p								1	1																5	606511.0477	4572135.101	
Irish	3		1	1							1																1	606460.8825	4572339.296	
Irish	3		5																		3						1	605432.4862	4572271.079	
Irish	3	p	3				1														3						1	605980.1459	4572075.828	
Irish	4			1										1													1	606059.4822	4572051.099	
Irish	4		5																								1	606403.4603	4572133.465	
Irish	4	p	1		1																1					3	606625.2856	4572218.914		
Irish	4	p		1																	1							606423.7095	4572393.902	
Irish	4		5																		1						1	606332.0503	4572429.807	
Irish	4		5																								3	605971.8521	4572677.252	
Irish	4		5				1				1										1						1	605876.7221	4572713.52	
Irish	4		3																									605617.9232	4572570.937	
Irish	4		3																									605498.4093	4572611.834	
Irish	4	p	1	1																								605456.4532	4572539.579	
Irish	4		3																									605447.8456	4572488.462	
Irish	4		3																		3					1	605522.0808	4572238.541		
Irish	4	p	5	1																								605713.9343	4572032.443	
Irish	4		3																									605786.5119	4572016.925	
Irish	4		5								1														1	1	605858.0841	4572038.3		
Irish	4	p																			3							606664.2366	4572375.313	
Irish	5	p	1																							1	606523.2897	4572277.139		
Irish	5		1																		1						5	606235.8622	4572423.239	
Irish	5		1																								5	606193.5396	4572461.036	
Irish	5		1																								5	606143.5193	4572624.643	
Irish	5	p	1							1																	3	606074.6462	4572655.817	
Irish	5		3	3										1							3						3	605765.8625	4572694.324	
Irish	5	p	3	3																							1	605546.3191	4572599.501	
Irish	5	p	3	3						1	1																	605454.336	4572589.948	
Irish	5		5																		1						1	605434.9711	4572327.24	
Irish	5		1							1	3										5							605610.003	4572231.597	
Irish	5		3	1				1																	1		605654.2313	4572181.54		
Irish	5		3	1						1																		605624.8372	4572155.89	
Irish	5	p																			3							606596.3616	4572304.732	
Irish	6		5																									606228.0284	4572149.929	
Irish	6	p	1				1				1	1									1					5	606159.4305	4572562.813		
Irish	6		1																									605643.2303	4572518.784	
Irish	6		3	5								1																605626.7699	4572108.507	
Irish	7	p	3																		1							606303.4035	4572381.729	
Irish	7	p	3	1																								605926.7198	4572088.107	
Irish	8	p	1																										606561.6385	4572254.387
Irish	8	p	3																							1	606138.6929	4572373.856		
Irish	8		5	1				1																				605460.823	4572419.273	
Irish	9	p	3																									606186.0686	4572476.276	
Irish	9	p	5																		3							605546.4451	4572298.759	

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	HETDUB	MYREXA	MYRHET	MYRSP1	NAJFLE	NAJGUA	NITELLA	POTAMP	POTBER	POTFOL	POTFRE	POTGRA	POTILL	POTNOD	POTPEC	POTPRA	POTRIC	POTZOS	UTRVUL	VALAME	X_COORD	Y_COORD
Irish	11	p	1	1								1															605683.5319	4572601.341
Kuhn	3	p	1									1									1						609109.9915	4570798.165
Kuhn	3			1					1																		609200.5015	4571111.369
Kuhn	3			3								3															609147.3693	4571205.52
Kuhn	3								3																1	1	609193.2771	4571401.458
Kuhn	3			3								1										1					609631.6562	4571652.505
Kuhn	3								3									1	1		3						609400.4968	4570881.6
Kuhn	4			1					1			1			1												609111.7265	4570903.626
Kuhn	4	p		3					5																		609354.3531	4571557.097
Kuhn	4			3					1					1													609503.9812	4571674.501
Kuhn	4			5					1			1										1					609700.5289	4571321.762
Kuhn	4	p							3																1	1	609684.4472	4571211.028
Kuhn	4			3															1		1				1	1	609550.9909	4571022.526
Kuhn	5	p							3												1	1					609166.7065	4571023.143
Kuhn	5	p		3					5					1				1	1								609316.1248	4571543.708
Kuhn	5	p		3					3			1														1	609604.4491	4571736.765
Kuhn	5								5										1	1	1	1					609581.729	4571098.936
Kuhn	6								5					3									3				609116.6901	4570856.911
Kuhn	6								1			1							1	1							609265.3422	4571125.658
Kuhn	6							1	1													3				1	609596.9632	4571521.933
Kuhn	6								5									1	1			1					609662.9199	4571382.735
Kuhn	6								5							1					1	1				1	609419.4809	4571088.441
Kuhn	6								5					1					1							1	609434.3982	4570982.871
Kuhn	7								5													1					609241.6437	4571207.18
Kuhn	7			3					3											1		3				3	609631.0175	4571209.422
Kuhn	7			5					3			1								1					3		609514.6483	4571154.412
Kuhn	8								1													5				1	609610.7682	4571279.252
Kuhn	8	p							3									3	1								609306.9456	4570789.809
Kuhn	9								5																		609182.269	4571369.548
Kuhn	9								1													3					609476.119	4571586.275
Kuhn	10									1																	609162.6128	4571296.007
Kuhn	10								3												1						609235.6858	4570734.613
Kuhn	11								3				1									3					609429.1769	4571532.566
Kuhn	11								1				1										3				609512.4298	4571531.641
Kuhn	11								5									1				1				1	609383.253	4571244.31
Kuhn	11								3													3					609198.8072	4570813.402
Kuhn	12																										609173.6262	4570935.832
Kuhn	12																					5				1	609616.668	4571469.336
Kuhn	13											1	5														609517.027	4571254.229
Kuhn	14												5														609277.2904	4571472.073
Kuhn	15												5														609286.0308	4571191.404
Kuhn	16			1		1						1	5														609424.7963	4571485.154
Kuhn	16																										609429.4675	4571271.42
Kuhn	17												1														609337.2746	4571491.113
Kuhn	17												1														609355.8623	4571094.607
Kuhn	17								1				1									1					609300.955	4570844.328
Kuhn	18																										609581.1144	4571422.699
Kuhn	18												1														609352.7535	4570993.758
Kuhn	18												1														609233.0862	4570807.689
Little Barbee	1	p																									607474.549	4571733.25
Little Barbee	2	p		5																							606819.2358	4572112.516
Little Barbee	3	p		5				1		1															1		607461.5226	4571589.959
Little Barbee	3	p		5																	1						606747.9597	4572080.053
Little Barbee	4			5		1																					606927.5398	4571763.882
Little Barbee	4	p		5						1																1	606977.3737	4571785.355
Little Barbee	4	p		5																							607099.6774	4571794.04
Little Barbee	4			5																							607170.5991	4571616.012
Little Barbee	4	p		3			3																				607389.3962	4571827.425
Little Barbee	4			5																	1						607164.4622	4571953.277
Little Barbee	4	p		5								1															606999.0189	4572134.877
Little Barbee	4	p		5						1																	606943.7801	4572119.126
Little Barbee	5	p		5																							606699.4299	4571982.792
Little Barbee	5			5																							607145.2699	4571657.986
Little Barbee	5			5																							607355.1401	4571526.274
Little Barbee	5	p		5																							607470.2069	4571636.275
Little Barbee	5	p																									607440.4081	4571780.289
Little Barbee	5	p		5																							607051.1575	4572076.068
Little Barbee	6	p		1																							606728.8229	4571934.694
Little Barbee	6	p		5																							607205.3362	4571566.801
Little Barbee	6			5																							607218.8225	4571916.418
Little Barbee	6	p										1															606694.3102	4572066.119
Little Barbee	7			5						1																	606871.4259	4571774.571
Little Barbee	7			5																							607056.256	4571827.329
Little Barbee	7			1																							607153.2305	4571779.566
Little Barbee	7	p		3																							607389.8773	4571553.774
Little Barbee	8			5																							606662.0207	4572017.529

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	HETDUB	MYREXA	MYRHET	MYRSP1	NAJFLE	NAJGUA	NITELLA	POTAMP	POTBER	POTFOL	POTFRE	POTGRA	POTILL	POTNOD	POTPEC	POTPRE	POTRIC	POTZOS	UTRVUL	VALAME	X_COOR	Y_COOR
Little Barbee	8		5								1																606826.3541	4571833.155
Little Barbee	8		1																								607162.6385	4571731.802
Little Barbee	8		5																								607258.1656	4571540.748
Little Barbee	9	p	3																								606893.0062	4572094.646
Little Barbee	11	p	5																								607425.3381	4571610.222
Little Barbee	11		5																								607079.1228	4572009.573
Little Barbee	12	p																									606802.3053	4571905.301
Little Barbee	12	p																									607378.2982	4571584.169
Little Barbee	12	p	5																								607294.9513	4571862.624
Little Barbee	12	p	5																								607009.6539	4572103.787
Little Barbee	13	p	1																								606987.5054	4571828.777
Little Barbee	14	p	5		1																						606968.1979	4572103.885
Little Barbee	14	p	1																								606815.4504	4572054.504
Sawmill	3	p	1																								606680.6499	4572604.133
Sawmill	3	p	1							1																	606631.2255	4572604.323
Sawmill	3	p	1							1											1						606480.0186	4572694.065
Sawmill	3	p	5							3																	606471.0027	4572727.961
Sawmill	3	p									1	3									1						606343.9867	4573052.495
Sawmill	4	p	5																		1						606593.532	4572613.274
Sawmill	4	p	3																								606539.0185	4572612.102
Sawmill	4	p	3																								606495.5638	4572641.265
Sawmill	4	p	3																		1						606368.8572	4572863.457
Sawmill	4	p	5							1																	606361.0065	4572894.616
Sawmill	4	p	5	1							1														1		606360.0428	4572953.305
Sawmill	4	p	1							1																	606355.3331	4573029.83
Sawmill	4	p	5																								606426.532	4573013.778
Sawmill	4	p	1																								606541.6077	4572963.767
Sawmill	4	p	3																								606602.1814	4572825.207
Sawmill	4	p	5									1															606601.1783	4572808.12
Sawmill	4	p	1																		1			1			606669.6509	4572667.419
Sawmill	5	p	5		1																						606542.7608	4572626.157
Sawmill	5	p	1																								606356.8769	4572992.34
Sawmill	5	p	5									1															606371.8052	4573001.291
Sawmill	5	p	3							1		1									1						606379.2454	4573048.883
Sawmill	5	p	3									3													1		606392.075	4573028.477
Sawmill	5	p	3	1																							606516.0739	4572984.845
Sawmill	5	p	1																								606584.9099	4572881.956
Sawmill	5	p	1																								606622.3035	4572764.526
Sawmill	6	p	5																								606489.6868	4572666.771
Sawmill	6	p	5																						1		606405.7483	4572805.62
Sawmill	6	p	3									1													1		606375.4134	4572842.015
Sawmill	6	p	5		1					1																	606366.0293	4572925.93
Sawmill	6	p	5							1		1															606505.6873	4572999.72
Sawmill	7	p	1																								606608.5531	4572636.199
Sawmill	7	p	5		1																						606446.2375	4572769.639
Sawmill	7	p	1																								606391.7744	4572814.803
Sawmill	7	p	5							1		1															606570.367	4572920.448
Sawmill	7		1																								606597.7277	4572833.082
Sawmill	8	p	5																								606446.1037	4573006.004
Sawmill	8	p	3																								606638.2363	4572661.57
Sawmill	9	p	5							1																	606378.9405	4572969.297
Sawmill	10	p	3																								606477.521	4572999.859
Sawmill	10		3							1																	606518.5891	4572965.824
Sawmill	10		1																								606642.35	4572707.944
Sechrist	2		1	5																							607003.2326	4572867.571
Sechrist	3		1	1																	5				1		607313.3673	4572344.548
Sechrist	3		3																								607391.0603	4572253.859
Sechrist	3						1		1									1	1		1				3		607675.0354	4572053.703
Sechrist	3		3																		1				1		607919.9794	4572096.387
Sechrist	3		1						1									1							1		607146.1023	4572657.079
Sechrist	4	p										1													3		607152.7564	4572465.842
Sechrist	4		3																		1						607432.8454	4572188.954
Sechrist	4		1												1			1			5				1		607860.3967	4572023.86
Sechrist	4								3												1	1				5	607652.758	4572325.331
Sechrist	4		3						1			1				1	1				1	1				3	607582.1903	4572448.563
Sechrist	4								1			1									3					5	607272.8407	4572650.392
Sechrist	4																				1	1				5	607094.919	4572797.374
Sechrist	4		5						3			1						1			1						606818.6712	4572889.198
Sechrist	5			3																	5	1			3		606932.7736	4572516.654
Sechrist	5		1						5												1		5	1			607396.0108	4572585.602
Sechrist	5								1												1				1	1	607726.3073	4572235.465
Sechrist	6	p		1								1									1						606840.0214	4572526.091
Sechrist	6	p		1																							607271.763	4572418.203
Sechrist	6		1				1																	1			607602.7637	4572313.966
Sechrist	6											5													1		606862.3502	4572843.162
Sechrist	7																								1		606968.9607	4572515.479

LAKE	DEPTH	FILALG	CERDEM	CHARA	ELOCAN	ELONUT	HETDUB	MYREXA	MYRHET	MYRSPI	NAJFLE	NAJGUA	NITELLA	POTAMP	POTBER	POTFOL	POTFRE	POTGRA	POTILL	POTNOD	POTPEC	POTPRA	POTRIC	POTZOS	UTRVUL	VALAME	X_COOR	Y_COOR
Sechrst	7			1						1											1						607257.8207	4572349.805
Sechrst	8						1														3			1			607603.6442	4572063.98
Sechrst	8								1																5		607737.0758	4572098.826
Sechrst	8								1																3		607877.5889	4572089.799
Sechrst	8								3																		607587.8291	4572428.042
Sechrst	9			1			1		1			3										1		3		5	607394.2116	4572574.057
Sechrst	11		1																								606942.6084	4572658.415
Sechrst	12		3																								607099.2228	4572468.593
Sechrst	12		1																								607200.9407	4572468.363
Sechrst	12						1		1				1											1			607793.5065	4572046.393
Sechrst	12																										607094.0661	4572621.393
Sechrst	13						1																	1			607477.5433	4572115.528
Sechrst	13		1																			1					607809.0981	4572218.805
Sechrst	13		5									1			1						1	1		1			606928.8716	4572884.398
Sechrst	13	p	3						1				1														606900.5676	4572815.431
Sechrst	13		3						1															1			606934.4281	4572759.151
Sechrst	14	p	3																								606915.07	4572537.192
Sechrst	16																										607641.6355	4572267.689
Sechrst	16						1		1																1		607250.5598	4572644.447
Sechrst	17	p	1																								606914.6814	4572591.152
Sechrst	18		1										1														607384.7434	4572309.98
Sechrst	18												1														607545.0656	4572462.12
Sechrst	19																										606925.3793	4572807.157
Sechrst	19		3																								606975.3344	4572850.085
Sechrst	20																										607034.5746	4572498.283
Sechrst	20		1										1														607525.2671	4572104.573
Sechrst	20											1															607845.4251	4572085.376

APPENDIX C1:
TIER II SPRING SURVEY RESULTS
BARBEE LAKES
AQUATIC PLANT MANAGEMENT PLAN REVISION 2007-2011

Occurrence and abundance of submersed aquatic plants in Banning Lake.							
Total Sites:	50	Mean species / site:	2.03	Native diversity:	0.81		
Littoral Sites:	47	Maximum species / site:	6	Species diversity:	0.85		
Littoral Depth (ft):	10	Number of species:	10	SE Mean natives / site:	0.27		
Date:	6/6/07	Littoral sites with plants:	21	Mean natives / site:	1.47		
Lake:	Banning	Secchi(ft):	10.5	SE Mean species / site:	0.33		
All depths (0-10')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Chara</i> species	Chara species	24.00	76.00	8.00	0.00	16.00	17.60
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	24.00	76.00	12.00	2.00	10.00	13.60
<i>Ceratophyllum demersum</i>	Coontail	24.00	76.00	16.00	4.00	4.00	9.60
<i>Nitella</i> species	Nitella species	12.00	88.00	8.00	0.00	4.00	5.60
<i>Stuckenia pectinatus</i>	Sago pondweed	8.00	92.00	6.00	2.00	0.00	2.40
<i>Myriophyllum exallescens</i>	Northern watermilfoil	8.00	92.00	6.00	2.00	0.00	2.40
<i>Potamogeton crispus</i>	Curly-leaf pondweed	10.00	90.00	10.00	0.00	0.00	2.00
<i>Utricularia vulgaris</i>	Common bladderwort	8.00	92.00	8.00	0.00	0.00	1.60
<i>Vallisneria americana</i>	Eel grass	2.00	98.00	2.00	0.00	0.00	0.40
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	2.00	98.00	2.00	0.00	0.00	0.40
Filamentous algae	Filamentous algae	20.00					
0-5' stratum							
0-5' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Chara</i> species	Chara species	100.00	0.00	0.00	0.00	100.00	100.00
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	40.00	60.00	20.00	0.00	20.00	24.00
<i>Stuckenia pectinatus</i>	Sago pondweed	40.00	60.00	20.00	20.00	0.00	16.00
<i>Ceratophyllum demersum</i>	Coontail	40.00	60.00	20.00	20.00	0.00	16.00
<i>Utricularia vulgaris</i>	Common bladderwort	20.00	80.00	20.00	0.00	0.00	4.00
5-10' stratum							
5-10' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	80.00	20.00	30.00	10.00	40.00	52.00
<i>Chara</i> species	Chara species	60.00	40.00	30.00	0.00	30.00	36.00
<i>Ceratophyllum demersum</i>	Coontail	60.00	40.00	30.00	10.00	20.00	32.00
<i>Nitella</i> species	Nitella species	20.00	80.00	0.00	0.00	20.00	20.00
<i>Myriophyllum exallescens</i>	Northern watermilfoil	40.00	60.00	30.00	10.00	0.00	12.00
<i>Potamogeton crispus</i>	Curly-leaf pondweed	30.00	70.00	30.00	0.00	0.00	6.00
<i>Utricularia vulgaris</i>	Common bladderwort	30.00	70.00	30.00	0.00	0.00	6.00
<i>Stuckenia pectinatus</i>	Sago pondweed	20.00	80.00	20.00	0.00	0.00	4.00
<i>Vallisneria americana</i>	Eel grass	10.00	90.00	10.00	0.00	0.00	2.00
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	10.00	90.00	10.00	0.00	0.00	2.00
Filamentous algae	Filamentous algae	30.00					

Occurrence and abundance of submersed aquatic plants in Big Barbee Lake.							
Total Sites:	68	Mean species / site:	2.97	Native diversity:	0.78		
Littoral Sites:	67	Maximum species / site:	8	Species diversity:	0.84		
Littoral Depth (ft):	17	Number of species:	13	SE Mean natives / site:	0.15		
Date:	6/7/07	Littoral sites with plants:	67	Mean natives / site:	2.18		
Lake:	Big Barbee	Secchi(ft):	N/A	SE Mean species / site:	0.20		
All depths (0-20')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	85.29	14.71	17.65	25.00	42.65	61.18
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	50.00	50.00	20.59	13.24	16.18	28.24
<i>Elodea canadensis</i>	Common water weed	36.76	63.24	16.18	10.29	10.29	19.71
<i>Chara</i> species	Chara species	32.35	67.65	20.59	7.35	4.41	12.94
<i>Potamogeton crispus</i>	Curly-leaf pondweed	29.41	70.59	25.00	2.94	1.47	8.24
<i>Najas guadalupensis</i>	Southern naiad	19.12	80.88	17.65	1.47	0.00	4.41
<i>Stuckenia pectinatus</i>	Sago pondweed	10.29	89.71	8.82	0.00	1.47	3.24
<i>Vallisneria americana</i>	Eel grass	13.24	86.76	11.76	1.47	0.00	3.24
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	5.88	94.12	5.88	0.00	0.00	1.18
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	5.88	94.12	5.88	0.00	0.00	1.18
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	5.88	94.12	5.88	0.00	0.00	1.18
<i>Utricularia vulgaris</i>	Common bladderwort	1.47	98.53	0.00	1.47	0.00	0.88
<i>Elodea nuttallii</i>	Nuttall's water-weed	1.47	98.53	1.47	0.00	0.00	0.29
<i>Filamentous algae</i>	Filamentous algae	80.88					
0-5' stratum							
0-5' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	75.76	0.00	18.18	18.18	39.39	53.94
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	60.61	0.00	27.27	21.21	12.12	30.30
<i>Elodea canadensis</i>	Common water weed	42.42	0.00	12.12	12.12	18.18	27.88
<i>Chara</i> species	Chara species	54.55	0.00	30.30	15.15	9.09	24.24
<i>Potamogeton crispus</i>	Curly-leaf pondweed	36.36	0.00	30.30	3.03	3.03	10.91
<i>Stuckenia pectinatus</i>	Sago pondweed	18.18	0.00	15.15	0.00	3.03	6.06
<i>Vallisneria americana</i>	Eel grass	24.24	0.00	21.21	3.03	0.00	6.06
<i>Najas guadalupensis</i>	Southern naiad	24.24	0.00	21.21	3.03	0.00	6.06
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	12.12	0.00	12.12	0.00	0.00	2.42
<i>Utricularia vulgaris</i>	Common bladderwort	3.03	0.00	0.00	3.03	0.00	1.82
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	9.09	0.00	9.09	0.00	0.00	1.82
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	6.06	0.00	6.06	0.00	0.00	1.21
<i>Elodea nuttallii</i>	Nuttall's water-weed	3.03	0.00	3.03	0.00	0.00	0.61
<i>Filamentous algae</i>	Filamentous algae	96.97					
5-10' stratum							
5-10' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	95.45	4.55	13.64	27.27	54.55	73.64
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	59.09	40.91	22.73	9.09	27.27	37.27
<i>Elodea canadensis</i>	Common water weed	50.00	50.00	31.82	13.64	4.55	19.09
<i>Potamogeton crispus</i>	Curly-leaf pondweed	31.82	68.18	27.27	4.55	0.00	8.18
<i>Najas guadalupensis</i>	Southern naiad	22.73	77.27	22.73	0.00	0.00	4.55
<i>Chara</i> species	Chara species	18.18	81.82	18.18	0.00	0.00	3.64
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	9.09	90.91	9.09	0.00	0.00	1.82
<i>Vallisneria americana</i>	Eel grass	4.55	95.45	4.55	0.00	0.00	0.91
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	4.55	95.45	4.55	0.00	0.00	0.91
<i>Stuckenia pectinatus</i>	Sago pondweed	4.55	95.45	4.55	0.00	0.00	0.91
<i>Filamentous algae</i>	Filamentous algae	81.82					

10-15' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	91.67	8.33	25.00	33.33	33.33	58.33
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	8.33	91.67	0.00	0.00	8.33	8.33
<i>Potamogeton crispus</i>	Curly-leaf pondweed	8.33	91.67	8.33	0.00	0.00	1.67
<i>Filamentous algae</i>	Filamentous algae	33.33					
15-20' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	100.00	0.00	0.00	100.00	0.00	60.00
<i>Filamentous algae</i>	Filamentous algae	100.00					

Occurrence and abundance of submersed aquatic plants in Irish Lake.							
Total Sites:	50	Mean species / site:	2.94	Native diversity:	0.84		
Littoral Sites:	47	Maximum species / site:	8	Species diversity:	0.87		
Littoral Depth (ft):	10	Number of species:	14	SE Mean natives / site:	0.19		
Date:	6/6/07	Littoral sites with plants:	47	Mean natives / site:	2.34		
Lake:	Irish	Secchi(ft):	11.5	SE Mean species / site:	0.23		
All depths (0-10')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Chara</i> species	Chara species	52.00	48.00	22.00	20.00	10.00	26.40
<i>Ceratophyllum demersum</i>	Coontail	54.00	46.00	26.00	18.00	10.00	26.00
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	46.00	54.00	26.00	10.00	10.00	21.20
<i>Vallisneria americana</i>	Eel grass	44.00	56.00	32.00	12.00	0.00	13.60
<i>Stuckenia pectinatus</i>	Sago pondweed	32.00	68.00	22.00	10.00	0.00	10.40
<i>Myriophyllum exalbesens</i>	Northern watermilfoil	12.00	88.00	6.00	6.00	0.00	4.80
<i>Potamogeton crispus</i>	Curly-leaf pondweed	14.00	86.00	14.00	0.00	0.00	2.80
<i>Najas guadalupensis</i>	Southern naiad	12.00	88.00	12.00	0.00	0.00	2.40
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	6.00	94.00	4.00	2.00	0.00	2.00
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	8.00	92.00	8.00	0.00	0.00	1.60
<i>Elodea canadensis</i>	Common water weed	6.00	94.00	6.00	0.00	0.00	1.20
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	4.00	96.00	4.00	0.00	0.00	0.80
<i>Potamogeton natans</i>	Floating-leaf pondweed	2.00	98.00	2.00	0.00	0.00	0.40
<i>Potamogeton illinoensis</i>	Illinois pondweed	2.00	98.00	2.00	0.00	0.00	0.40
<i>Filamentous algae</i>	Filamentous algae	52.00					
0-5' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Chara</i> species	Chara species	64.52	35.48	29.03	22.58	12.90	32.26
<i>Ceratophyllum demersum</i>	Coontail	41.94	58.06	32.26	0.00	9.68	16.13
<i>Vallisneria americana</i>	Eel grass	48.39	51.61	35.48	12.90	0.00	14.84
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	35.48	64.52	25.81	3.23	6.45	13.55
<i>Stuckenia pectinatus</i>	Sago pondweed	38.71	61.29	29.03	9.68	0.00	11.61
<i>Najas guadalupensis</i>	Southern naiad	12.90	87.10	12.90	0.00	0.00	2.58
<i>Myriophyllum exalbesens</i>	Northern watermilfoil	6.45	93.55	3.23	3.23	0.00	2.58
<i>Potamogeton crispus</i>	Curly-leaf pondweed	9.68	90.32	9.68	0.00	0.00	1.94
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	3.23	96.77	0.00	3.23	0.00	1.94
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	6.45	93.55	6.45	0.00	0.00	1.29
<i>Potamogeton illinoensis</i>	Illinois pondweed	3.23	96.77	3.23	0.00	0.00	0.65
<i>Elodea canadensis</i>	Common water weed	3.23	96.77	3.23	0.00	0.00	0.65
<i>Filamentous algae</i>	Filamentous algae	61.29					
5-10' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	73.68	26.32	15.79	47.37	10.53	42.11
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	63.16	36.84	26.32	21.05	15.79	33.68
<i>Chara</i> species	Chara species	31.58	68.42	10.53	15.79	5.26	16.84
<i>Vallisneria americana</i>	Eel grass	36.84	63.16	26.32	10.53	0.00	11.58
<i>Myriophyllum exalbesens</i>	Northern watermilfoil	21.05	78.95	10.53	10.53	0.00	8.42
<i>Stuckenia pectinatus</i>	Sago pondweed	21.05	78.95	10.53	10.53	0.00	8.42
<i>Potamogeton crispus</i>	Curly-leaf pondweed	21.05	78.95	21.05	0.00	0.00	4.21
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	10.53	89.47	10.53	0.00	0.00	2.11
<i>Najas guadalupensis</i>	Southern naiad	10.53	89.47	10.53	0.00	0.00	2.11
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	10.53	89.47	10.53	0.00	0.00	2.11
<i>Elodea canadensis</i>	Common water weed	10.53	89.47	10.53	0.00	0.00	2.11
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	10.53	89.47	10.53	0.00	0.00	2.11

<i>Potamogeton natans</i>	Floating-leaf pondweed	5.26	94.74	5.26	0.00	0.00	1.05
<i>Filamentous algae</i>	Filamentous algae	36.84					

Occurrence and abundance of submersed aquatic plant species in Kuhn Lake.							
Total Sites:	50	Mean species / site:	3.08	Native diversity:	0.87		
Littoral Sites:	47	Maximum species / site:	6	Species diversity:	0.88		
Littoral Depth (ft):	15	Number of species:	16	SE Mean natives / site:	0.19		
Date:	6/7/07	Littoral sites with plants:	47	Mean natives / site:	2.62		
Lake:	Kuhn	Secchi(ft):	9.5	SE Mean species / site:	0.23		
All depths (0-15')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	68.00	32.00	22.00	14.00	32.00	44.80
<i>Potamogeton crispus</i>	Curly-leaf pondweed	42.00	58.00	30.00	10.00	2.00	14.00
<i>Potamogeton praelongus</i>	White-stemmed pondweed	22.00	78.00	4.00	12.00	6.00	14.00
<i>Chara</i> species	Chara species	30.00	70.00	18.00	8.00	4.00	12.40
<i>Potamogeton illinoensis</i>	Illinois pondweed	34.00	66.00	30.00	2.00	2.00	9.20
<i>Vallisneria americana</i>	Eel grass	36.00	64.00	34.00	2.00	0.00	8.00
<i>Nitella</i> species	Nitella species	16.00	84.00	12.00	0.00	4.00	6.40
<i>Elodea canadensis</i>	Common water weed	8.00	92.00	4.00	2.00	2.00	4.00
<i>Potamogeton gramineus</i>	Grassy pondweed	14.00	86.00	14.00	0.00	0.00	2.80
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	4.00	96.00	2.00	0.00	2.00	2.40
<i>Potamogeton friesii</i>	Flat-stalked pondweed	2.00	98.00	0.00	0.00	2.00	2.00
<i>Utricularia vulgaris</i>	Common bladderwort	10.00	90.00	10.00	0.00	0.00	2.00
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	8.00	92.00	8.00	0.00	0.00	1.60
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	6.00	94.00	6.00	0.00	0.00	1.20
<i>Najas guadalupensis</i>	Southern naiad	4.00	96.00	4.00	0.00	0.00	0.80
<i>Ceratophyllum demersum</i>	Coontail	4.00	96.00	4.00	0.00	0.00	0.80
Filamentous algae	Filamentous algae	6.00					
0-5' stratum							
0-5' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	78.26	21.74	26.09	8.70	43.48	53.91
<i>Chara</i> species	Chara species	52.17	47.83	26.09	17.39	8.70	24.35
<i>Vallisneria americana</i>	Eel grass	47.83	52.17	47.83	0.00	0.00	9.57
<i>Potamogeton illinoensis</i>	Illinois pondweed	47.83	52.17	47.83	0.00	0.00	9.57
<i>Potamogeton praelongus</i>	White-stemmed pondweed	17.39	82.61	8.70	4.35	4.35	8.70
<i>Potamogeton crispus</i>	Curly-leaf pondweed	21.74	78.26	17.39	4.35	0.00	6.09
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	4.35	95.65	0.00	0.00	4.35	4.35
<i>Potamogeton friesii</i>	Flat-stalked pondweed	4.35	95.65	0.00	0.00	4.35	4.35
<i>Elodea canadensis</i>	Common water weed	8.70	91.30	4.35	4.35	0.00	3.48
<i>Potamogeton gramineus</i>	Grassy pondweed	13.04	86.96	13.04	0.00	0.00	2.61
<i>Utricularia vulgaris</i>	Common bladderwort	13.04	86.96	13.04	0.00	0.00	2.61
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	13.04	86.96	13.04	0.00	0.00	2.61
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	8.70	91.30	8.70	0.00	0.00	1.74
<i>Najas guadalupensis</i>	Southern naiad	4.35	95.65	4.35	0.00	0.00	0.87
Filamentous algae	Filamentous algae	8.70					

5-10' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	87.50	12.50	25.00	25.00	37.50	57.50
<i>Potamogeton praelongus</i>	White-stemmed pondweed	43.75	56.25	0.00	31.25	12.50	31.25
<i>Potamogeton crispus</i>	Curly-leaf pondweed	81.25	18.75	56.25	18.75	6.25	28.75
<i>Potamogeton illinoensis</i>	Illinois pondweed	25.00	75.00	12.50	6.25	6.25	12.50
<i>Elodea canadensis</i>	Common water weed	12.50	87.50	6.25	0.00	6.25	7.50
<i>Vallisneria americana</i>	Eel grass	37.50	62.50	37.50	0.00	0.00	7.50
<i>Nitella</i> species	Nitella species	6.25	93.75	0.00	0.00	6.25	6.25
<i>Chara</i> species	Chara species	18.75	81.25	18.75	0.00	0.00	3.75
<i>Potamogeton gramineus</i>	Grassy pondweed	12.50	87.50	12.50	0.00	0.00	2.50
<i>Utricularia vulgaris</i>	Common bladderwort	12.50	87.50	12.50	0.00	0.00	2.50
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	6.25	93.75	6.25	0.00	0.00	1.25
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	6.25	93.75	6.25	0.00	0.00	1.25
<i>Najas guadalupensis</i>	Southern naiad	6.25	93.75	6.25	0.00	0.00	1.25
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	6.25	93.75	6.25	0.00	0.00	1.25
<i>Ceratophyllum demersum</i>	Coontail	6.25	93.75	6.25	0.00	0.00	1.25
10-15' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Nitella</i> species	Nitella species	63.64	36.36	54.55	0.00	9.09	20.00
<i>Potamogeton crispus</i>	Curly-leaf pondweed	27.27	72.73	18.18	9.09	0.00	9.09
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	18.18	81.82	9.09	9.09	0.00	7.27
<i>Vallisneria americana</i>	Eel grass	9.09	90.91	0.00	9.09	0.00	5.45
<i>Potamogeton gramineus</i>	Grassy pondweed	18.18	81.82	18.18	0.00	0.00	3.64
<i>Potamogeton illinoensis</i>	Illinois pondweed	18.18	81.82	18.18	0.00	0.00	3.64
<i>Ceratophyllum demersum</i>	Coontail	9.09	90.91	9.09	0.00	0.00	1.82
<i>Filamentous algae</i>	Filamentous algae	9.09					

Occurrence and abundance of submersed aquatic plant species in Little Barbee Lake.							
Total Sites:	41	Mean species / site:	2.22	Native diversity:	0.65		
Littoral Sites:	38	Maximum species / site:	5	Species diversity:	0.76		
Littoral Depth (ft):	14	Number of species:	8	SE Mean natives / site:	0.15		
Date:	6/6/07	Littoral sites with plants:	38	Mean natives / site:	1.59		
Lake:	Little Barbee	Secchi(ft):	6.5	SE Mean species / site:	0.21		
All depths (0-15')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	85.37	14.63	19.51	4.88	60.98	67.80
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	56.10	43.90	24.39	7.32	24.39	33.66
<i>Elodea canadensis</i>	Common water weed	29.27	70.73	19.51	7.32	2.44	10.73
<i>Stuckenia pectinatus</i>	Sago pondweed	14.63	85.37	7.32	7.32	0.00	5.85
<i>Chara</i> species	Chara species	14.63	85.37	9.76	4.88	0.00	4.88
<i>Vallisneria americana</i>	Eel grass	9.76	90.24	9.76	0.00	0.00	1.95
<i>Potamogeton crispus</i>	Curly-leaf pondweed	7.32	92.68	7.32	0.00	0.00	1.46
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	4.88	95.12	4.88	0.00	0.00	0.98
<i>Filamentous algae</i>	Filamentous algae	60.98					
0-5' stratum							
0-5' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	94.12	5.88	11.76	0.00	82.35	84.71
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	70.59	29.41	17.65	11.76	41.18	51.76
<i>Elodea canadensis</i>	Common water weed	47.06	52.94	29.41	11.76	5.88	18.82
<i>Stuckenia pectinatus</i>	Sago pondweed	35.29	64.71	17.65	17.65	0.00	14.12
<i>Chara</i> species	Chara species	23.53	76.47	17.65	5.88	0.00	7.06
<i>Vallisneria americana</i>	Eel grass	23.53	76.47	23.53	0.00	0.00	4.71
<i>Potamogeton crispus</i>	Curly-leaf pondweed	5.88	94.12	5.88	0.00	0.00	1.18
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	5.88	94.12	5.88	0.00	0.00	1.18
<i>Filamentous algae</i>	Filamentous algae	82.35					
5-10' stratum							
5-10' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	100.00	0.00	23.08	0.00	76.92	81.54
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	61.54	38.46	30.77	7.69	23.08	33.85
<i>Elodea canadensis</i>	Common water weed	30.77	69.23	23.08	7.69	0.00	9.23
<i>Chara</i> species	Chara species	15.38	84.62	7.69	7.69	0.00	6.15
<i>Potamogeton crispus</i>	Curly-leaf pondweed	7.69	92.31	7.69	0.00	0.00	1.54
<i>Filamentous algae</i>	Filamentous algae	61.54					
10-15' stratum							
10-15' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	54.55	45.45	27.27	18.18	9.09	25.45
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	27.27	72.73	27.27	0.00	0.00	5.45
<i>Potamogeton crispus</i>	Curly-leaf pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Filamentous algae</i>	Filamentous algae	27.27					

Occurrence and abundance of submersed aquatic plant species in Sawmill Lake.							
Total Sites:	41	Mean species / site:	2.41	Native diversity:	0.60		
Littoral Sites:	37	Maximum species / site:	7	Species diversity:	0.78		
Littoral Depth (ft):	14	Number of species:	7	SE Mean natives / site:	0.17		
Date:	6/6/07	Littoral sites with plants:	37	Mean natives / site:	1.49		
Lake:	Sawmill	Secchi(ft):	7.5	SE Mean species / site:	0.25		
All depths (0-15')		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	87.80	12.20	21.95	26.83	39.02	59.51
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	48.78	51.22	14.63	14.63	19.51	31.22
<i>Potamogeton crispus</i>	Curly-leaf pondweed	43.90	56.10	43.90	0.00	0.00	8.78
<i>Elodea canadensis</i>	Common water weed	14.63	85.37	9.76	2.44	2.44	5.85
<i>Chara</i> species	Chara species	24.39	75.61	21.95	2.44	0.00	5.85
<i>Najas guadalupensis</i>	Southern naiad	12.20	87.80	9.76	2.44	0.00	3.41
<i>Stuckenia pectinatus</i>	Sago pondweed	9.76	90.24	9.76	0.00	0.00	1.95
Filamentous algae	Filamentous algae	75.61					
0-5' stratum							
0-5' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	93.75	6.25	37.50	18.75	37.50	56.25
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	62.50	37.50	18.75	18.75	25.00	40.00
<i>Elodea canadensis</i>	Common water weed	25.00	75.00	12.50	6.25	6.25	12.50
<i>Chara</i> species	Chara species	50.00	50.00	43.75	6.25	0.00	12.50
<i>Potamogeton crispus</i>	Curly-leaf pondweed	50.00	50.00	50.00	0.00	0.00	10.00
<i>Najas guadalupensis</i>	Southern naiad	12.50	87.50	6.25	6.25	0.00	5.00
<i>Stuckenia pectinatus</i>	Sago pondweed	18.75	81.25	18.75	0.00	0.00	3.75
Filamentous algae	Filamentous algae	100.00					
5-10' stratum							
5-10' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	87.50	12.50	6.25	25.00	56.25	72.50
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	50.00	50.00	12.50	12.50	25.00	35.00
<i>Potamogeton crispus</i>	Curly-leaf pondweed	50.00	50.00	50.00	0.00	0.00	10.00
<i>Najas guadalupensis</i>	Southern naiad	18.75	81.25	18.75	0.00	0.00	3.75
<i>Elodea canadensis</i>	Common water weed	12.50	87.50	12.50	0.00	0.00	2.50
<i>Chara</i> species	Chara species	12.50	87.50	12.50	0.00	0.00	2.50
<i>Stuckenia pectinatus</i>	Sago pondweed	6.25	93.75	6.25	0.00	0.00	1.25
Filamentous algae	Filamentous algae	62.50					
10-15' stratum							
10-15' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	77.78	22.22	22.22	44.44	11.11	42.22
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	22.22	77.78	11.11	11.11	0.00	8.89
<i>Potamogeton crispus</i>	Curly-leaf pondweed	22.22	77.78	22.22	0.00	0.00	4.44
Filamentous algae	Filamentous algae	55.56					

Occurrence and abundance of submersed aquatic plant species in Sechrist Lake.							
Total Sites:	50	Mean species / site:	2.74	Native diversity:	0.87		
Littoral Sites:	43	Maximum species / site:	6	Species diversity:	0.89		
Littoral Depth (ft):	20	Number of species:	16	SE Mean natives / site:	0.22		
Date:	6/6/07	Littoral sites with plants:	43	Mean natives / site:	2.40		
Lake:	Sechrist	Secchi(ft):	13.2	SE Mean species / site:	0.25		
All depths (0-20')		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	46.00	54.00	22.00	12.00	12.00	23.60
<i>Vallisneria americana</i>	Eel grass	52.00	48.00	34.00	12.00	6.00	20.00
<i>Chara</i> species	Chara species	32.00	68.00	20.00	8.00	4.00	12.80
<i>Potamogeton crispus</i>	Curly-leaf pondweed	32.00	68.00	22.00	6.00	4.00	12.00
<i>Ceratophyllum demersum</i>	Coontail	26.00	74.00	18.00	4.00	4.00	10.00
<i>Potamogeton nodosus</i>	Long-leaf pondweed	18.00	82.00	16.00	2.00	0.00	4.40
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	16.00	84.00	14.00	2.00	0.00	4.00
<i>Potamogeton illinoensis</i>	Illinois pondweed	12.00	88.00	12.00	0.00	0.00	2.40
<i>Nitella</i> species	Nitella species	8.00	92.00	6.00	2.00	0.00	2.40
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	2.00	98.00	0.00	0.00	2.00	2.00
<i>Najas guadalupensis</i>	Southern naiad	8.00	92.00	8.00	0.00	0.00	1.60
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	8.00	92.00	8.00	0.00	0.00	1.60
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	2.00	98.00	0.00	2.00	0.00	1.20
<i>Potamogeton gramineus</i>	Grassy pondweed	6.00	94.00	6.00	0.00	0.00	1.20
<i>Stuckenia pectinatus</i>	Sago pondweed	4.00	96.00	4.00	0.00	0.00	0.80
<i>Potamogeton praelongus</i>	White-stemmed pondweed	2.00	98.00	2.00	0.00	0.00	0.40
<i>Filamentous algae</i>	Filamentous algae	16.00					
0-5' stratum							
Scientific Name	Common Name	Frequency of Occurrence	Frequency per Species				Dominance
<i>Chara</i> species	Chara species	72.73	27.27	27.27	27.27	18.18	40.00
<i>Vallisneria americana</i>	Eel grass	81.82	18.18	54.55	18.18	9.09	30.91
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	36.36	63.64	9.09	18.18	9.09	21.82
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	45.45	54.55	45.45	0.00	0.00	9.09
<i>Potamogeton nodosus</i>	Long-leaf pondweed	36.36	63.64	36.36	0.00	0.00	7.27
<i>Potamogeton crispus</i>	Curly-leaf pondweed	27.27	72.73	27.27	0.00	0.00	5.45
<i>Potamogeton illinoensis</i>	Illinois pondweed	27.27	72.73	27.27	0.00	0.00	5.45
<i>Potamogeton gramineus</i>	Grassy pondweed	18.18	81.82	18.18	0.00	0.00	3.64
<i>Stuckenia pectinatus</i>	Sago pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Filamentous algae</i>	Filamentous algae	18.18					
5-10' stratum							
Scientific Name	Common Name	Frequency of Occurrence	Frequency per Species				Dominance
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	80.00	20.00	33.33	13.33	33.33	48.00
<i>Vallisneria americana</i>	Eel grass	66.67	33.33	46.67	20.00	0.00	21.33
<i>Potamogeton crispus</i>	Curly-leaf pondweed	40.00	60.00	26.67	6.67	6.67	16.00
<i>Chara</i> species	Chara species	46.67	53.33	40.00	6.67	0.00	12.00
<i>Ceratophyllum demersum</i>	Coontail	20.00	80.00	13.33	0.00	6.67	9.33
<i>Potamogeton nodosus</i>	Long-leaf pondweed	26.67	73.33	20.00	6.67	0.00	8.00
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	6.67	93.33	0.00	0.00	6.67	6.67
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	13.33	86.67	6.67	6.67	0.00	5.33
<i>Najas guadalupensis</i>	Southern naiad	26.67	73.33	26.67	0.00	0.00	5.33
<i>Potamogeton illinoensis</i>	Illinois pondweed	6.67	93.33	6.67	0.00	0.00	1.33
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	6.67	93.33	6.67	0.00	0.00	1.33
<i>Potamogeton praelongus</i>	White-stemmed pondweed	6.67	93.33	6.67	0.00	0.00	1.33
<i>Stuckenia pectinatus</i>	Sago pondweed	6.67	93.33	6.67	0.00	0.00	1.33

<i>Filamentous algae</i>	Filamentous algae	6.67					

10-15' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Vallisneria americana</i>	Eel grass	36.36	63.64	18.18	0.00	18.18	21.82
<i>Potamogeton crispus</i>	Curly-leaf pondweed	45.45	54.55	36.36	9.09	0.00	12.73
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	27.27	72.73	18.18	9.09	0.00	9.09
<i>Ceratophyllum demersum</i>	Coontail	27.27	72.73	18.18	9.09	0.00	9.09
<i>Nitella</i> species	Nitella species	18.18	81.82	9.09	9.09	0.00	7.27
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	9.09	90.91	0.00	9.09	0.00	5.45
<i>Potamogeton illinoensis</i>	Illinois pondweed	18.18	81.82	18.18	0.00	0.00	3.64
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	18.18	81.82	18.18	0.00	0.00	3.64
<i>Chara</i> species	Chara species	9.09	90.91	9.09	0.00	0.00	1.82
<i>Potamogeton nodosus</i>	Long-leaf pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Filamentous algae</i>	Filamentous algae	18.18					
15-20' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	63.64	36.36	45.45	9.09	9.09	23.64
<i>Potamogeton crispus</i>	Curly-leaf pondweed	18.18	81.82	0.00	9.09	9.09	14.55
<i>Myriophyllum heterophyllum</i>	Various-leaf watermilfoil	36.36	63.64	27.27	9.09	0.00	10.91
<i>Vallisneria americana</i>	Eel grass	27.27	72.73	18.18	9.09	0.00	9.09
<i>Nitella</i> species	Nitella species	18.18	81.82	18.18	0.00	0.00	3.64
<i>Potamogeton gramineus</i>	Grassy pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Filamentous algae</i>	Filamentous algae	18.18					

APPENDIX C2:
TIER II SUMMER SURVEY RESULTS
BARBEE LAKES
AQUATIC PLANT MANAGEMENT PLAN REVISION 2007-2011

Occurrence and abundance of submersed aquatic plants in Banning Lake.							
Total Sites:	29.00	Mean species / site:	1.14	Native diversity:	0.76		
Littoral Sites:	25.00	Maximum species / site:	5.00	Species diversity:	0.80		
Littoral Depth (ft):	10.00	Number of species:	7.00	SE Mean natives / site:	0.25		
Date:	8/24/07	Littoral sites with plants:	15.00	Mean natives / site:	1.03		
Lake:	Banning	Secchi(ft):	6.20	SE Mean species / site:	0.27		
All depths (0-15')		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Chara species</i>	Chara species	31.03	68.97	6.90	13.79	10.34	20.00
<i>Ceratophyllum demersum</i>	Coontail	34.48	65.52	13.79	17.24	3.45	16.55
<i>Utricularia vulgaris</i>	Common bladderwort	13.79	86.21	10.34	3.45	0.00	4.14
<i>Nitella species</i>	Nitella species	10.34	89.66	6.90	3.45	0.00	3.45
<i>Stuckenia pectinatus</i>	Sago pondweed	6.90	93.10	3.45	3.45	0.00	2.76
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	10.34	89.66	10.34	0.00	0.00	2.07
<i>Najas guadalupensis</i>	Southern naiad	6.90	93.10	6.90	0.00	0.00	1.38
<i>Filamentous algae</i>	Filamentous algae	34.48					
0-5' stratum							
0-5' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Chara species</i>	Chara species	56.25	43.75	12.50	25.00	18.75	36.25
<i>Ceratophyllum demersum</i>	Coontail	50.00	50.00	18.75	25.00	6.25	25.00
<i>Utricularia vulgaris</i>	Common bladderwort	25.00	75.00	18.75	6.25	0.00	7.50
<i>Stuckenia pectinatus</i>	Sago pondweed	12.50	87.50	6.25	6.25	0.00	5.00
<i>Nitella species</i>	Nitella species	12.50	87.50	12.50	0.00	0.00	2.50
<i>Najas guadalupensis</i>	Southern naiad	12.50	87.50	12.50	0.00	0.00	2.50
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	12.50	87.50	12.50	0.00	0.00	2.50
<i>Filamentous algae</i>	Filamentous algae	56.25					
5-10' stratum							
5-10' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	22.22	77.78	11.11	11.11	0.00	8.89
<i>Nitella species</i>	Nitella species	11.11	88.89	0.00	11.11	0.00	6.67
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	11.11	88.89	11.11	0.00	0.00	2.22
<i>Filamentous algae</i>	Filamentous algae	0.00					
10-15' stratum							
10-15' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Filamentous algae</i>	Filamentous algae	25.00					

Occurrence and abundance of submersed aquatic plants in Big Barbee Lake.							
Total Sites:	73	Mean species / site:	1.47	Native diversity:	0.61		
Littoral Sites:	67	Maximum species / site:	5	Species diversity:	0.63		
Littoral Depth (ft):	15	Number of species:	11	SE Mean natives / site:	0.12		
Date:	8/8/07	Littoral sites with plants:	67	Mean natives / site:	1.42		
Lake:	Big Barbee	Secchi(ft):	4.5	SE Mean species / site:	0.13		
All depths (0-15')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	84.93	15.07	24.66	16.44	43.84	58.63
<i>Elodea canadensis</i>	Common water weed	15.07	84.93	6.85	5.48	2.74	7.40
<i>Najas guadalupensis</i>	Southern naiad	13.70	86.30	12.33	1.37	0.00	3.29
<i>Vallisneria americana</i>	Eel grass	10.96	89.04	9.59	1.37	0.00	2.74
<i>Stuckenia pectinatus</i>	Sago pondweed	8.22	91.78	8.22	0.00	0.00	1.64
<i>Chara</i> species	Chara species	2.74	97.26	1.37	1.37	0.00	1.10
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	4.11	95.89	4.11	0.00	0.00	0.82
<i>Utricularia vulgaris</i>	Common bladderwort	2.74	97.26	2.74	0.00	0.00	0.55
<i>Potamogeton illinoensis</i>	Illinois pondweed	1.37	98.63	1.37	0.00	0.00	0.27
<i>Potamogeton friesii</i>	Flat-stalked pondweed	1.37	98.63	1.37	0.00	0.00	0.27
<i>Elodea nuttallii</i>	Nuttall's water-weed	1.37	98.63	1.37	0.00	0.00	0.27
<i>Filamentous algae</i>	Filamentous algae	63.01					
0-5' stratum							
0-5' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	89.74	10.26	33.33	17.95	38.46	55.90
<i>Elodea canadensis</i>	Common water weed	17.95	82.05	5.13	7.69	5.13	10.77
<i>Najas guadalupensis</i>	Southern naiad	17.95	82.05	15.38	2.56	0.00	4.62
<i>Vallisneria americana</i>	Eel grass	17.95	82.05	15.38	2.56	0.00	4.62
<i>Stuckenia pectinatus</i>	Sago pondweed	12.82	87.18	12.82	0.00	0.00	2.56
<i>Chara</i> species	Chara species	2.56	97.44	0.00	2.56	0.00	1.54
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	2.56	97.44	2.56	0.00	0.00	0.51
<i>Utricularia vulgaris</i>	Common bladderwort	2.56	97.44	2.56	0.00	0.00	0.51
<i>Potamogeton illinoensis</i>	Illinois pondweed	2.56	97.44	2.56	0.00	0.00	0.51
<i>Potamogeton friesii</i>	Flat-stalked pondweed	2.56	97.44	2.56	0.00	0.00	0.51
<i>Filamentous algae</i>	Filamentous algae	69.23					
5-10' stratum							
5-10' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	86.96	13.04	8.70	13.04	65.22	74.78
<i>Elodea canadensis</i>	Common water weed	17.39	82.61	13.04	4.35	0.00	5.22
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	8.70	91.30	8.70	0.00	0.00	1.74
<i>Najas guadalupensis</i>	Southern naiad	8.70	91.30	8.70	0.00	0.00	1.74
<i>Utricularia vulgaris</i>	Common bladderwort	4.35	95.65	4.35	0.00	0.00	0.87
<i>Stuckenia pectinatus</i>	Sago pondweed	4.35	95.65	4.35	0.00	0.00	0.87
<i>Elodea nuttallii</i>	Nuttall's water-weed	4.35	95.65	4.35	0.00	0.00	0.87
<i>Chara</i> species	Chara species	4.35	95.65	4.35	0.00	0.00	0.87
<i>Vallisneria americana</i>	Eel grass	4.35	95.65	4.35	0.00	0.00	0.87
<i>Filamentous algae</i>	Filamentous algae	60.87					
10-15' stratum							
10-15' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	63.64	36.36	27.27	18.18	18.18	34.55
<i>Najas guadalupensis</i>	Southern naiad	9.09	90.91	9.09	0.00	0.00	1.82
<i>Filamentous algae</i>	Filamentous algae	45.45					

Occurrence and abundance of submersed aquatic plants in Irish Lake.							
Total Sites:	48	Mean species / site:	2.77	Native diversity:	0.83		
Littoral Sites:	48	Maximum species / site:	6	Species diversity:	0.84		
Littoral Depth (ft):	11	Number of species:	16	SE Mean natives / site:	0.19		
Date:	8/8/07	Littoral sites with plants:	48	Mean natives / site:	2.67		
Lake:	Irish	Secchi(ft):	11.0	SE Mean species / site:	0.20		
All depths (0-10')		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Chara</i> species	Chara species	56.25	43.75	22.92	18.75	14.58	30.42
<i>Ceratophyllum demersum</i>	Coontail	60.42	39.58	27.08	20.83	12.50	30.42
<i>Vallisneria americana</i>	Eel grass	58.33	41.67	35.42	10.42	12.50	25.83
<i>Stuckenia pectinatus</i>	Sago pondweed	37.50	62.50	20.83	14.58	2.08	15.00
<i>Najas guadalupensis</i>	Southern naiad	18.75	81.25	16.67	2.08	0.00	4.58
<i>Potamogeton illinoensis</i>	Illinois pondweed	6.25	93.75	2.08	4.17	0.00	2.92
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	10.42	89.58	10.42	0.00	0.00	2.08
<i>Heteranthera dubia</i>	Water star grass	6.25	93.75	6.25	0.00	0.00	1.25
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	4.17	95.83	4.17	0.00	0.00	0.83
<i>Najas flexilis</i>	Slender naiad	4.17	95.83	4.17	0.00	0.00	0.83
<i>Myriophyllum exalbenscens</i>	Northern water milfoil	4.17	95.83	4.17	0.00	0.00	0.83
<i>Potamogeton friesii</i>	Flat-stalked pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Elodea canadensis</i>	Common water weed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Utricularia vulgaris</i>	Common bladderwort	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton gramineus</i>	Grassy pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Filamentous algae</i>	Filamentous algae	41.67					
0-5' stratum							
0-5' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Chara</i> species	Chara species	63.89	36.11	22.22	25.00	16.67	36.11
<i>Vallisneria americana</i>	Eel grass	72.22	27.78	44.44	13.89	13.89	31.11
<i>Ceratophyllum demersum</i>	Coontail	47.22	52.78	25.00	13.89	8.33	21.67
<i>Stuckenia pectinatus</i>	Sago pondweed	38.89	61.11	19.44	16.67	2.78	16.67
<i>Najas guadalupensis</i>	Southern naiad	16.67	83.33	13.89	2.78	0.00	4.44
<i>Potamogeton illinoensis</i>	Illinois pondweed	8.33	91.67	2.78	5.56	0.00	3.89
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	13.89	86.11	13.89	0.00	0.00	2.78
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	5.56	94.44	5.56	0.00	0.00	1.11
<i>Heteranthera dubia</i>	Water star grass	5.56	94.44	5.56	0.00	0.00	1.11
<i>Potamogeton friesii</i>	Flat-stalked pondweed	2.78	97.22	2.78	0.00	0.00	0.56
<i>Najas flexilis</i>	Slender naiad	2.78	97.22	2.78	0.00	0.00	0.56
<i>Myriophyllum exalbenscens</i>	Northern water milfoil	2.78	97.22	2.78	0.00	0.00	0.56
<i>Elodea canadensis</i>	Common water weed	2.78	97.22	2.78	0.00	0.00	0.56
<i>Utricularia vulgaris</i>	Common bladderwort	2.78	97.22	2.78	0.00	0.00	0.56
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	2.78	97.22	2.78	0.00	0.00	0.56
<i>Potamogeton gramineus</i>	Grassy pondweed	2.78	97.22	2.78	0.00	0.00	0.56
<i>Filamentous algae</i>	Filamentous algae	33.33					

5-10' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	100.00	0.00	33.33	41.67	25.00	56.67
<i>Chara</i> species	Chara species	33.33	66.67	25.00	0.00	8.33	13.33
<i>Vallisneria americana</i>	Eel grass	16.67	83.33	8.33	0.00	8.33	10.00
<i>Stuckenia pectinatus</i>	Sago pondweed	33.33	66.67	25.00	8.33	0.00	10.00
<i>Najas guadalupensis</i>	Southern naiad	25.00	75.00	25.00	0.00	0.00	5.00
<i>Najas flexilis</i>	Slender naiad	8.33	91.67	8.33	0.00	0.00	1.67
<i>Myriophyllum exalbescens</i>	Northern water milfoil	8.33	91.67	8.33	0.00	0.00	1.67
<i>Heteranthera dubia</i>	Water star grass	8.33	91.67	8.33	0.00	0.00	1.67
<i>Filamentous algae</i>	Filamentous algae	66.67					

Occurrence and abundance of submersed aquatic plants in Kuhn Lake.							
Total Sites:	48	Mean species / site:	3.02	Native diversity:	0.89		
Littoral Sites:	45	Maximum species / site:	6	Species diversity:	0.89		
Littoral Depth (ft):	18	Number of species:	19	SE Mean natives / site:	0.22		
Date:	8/8/07	Littoral sites with plants:	45	Mean natives / site:	3.00		
Lake:	Kuhn	Secchi(ft):	11.5	SE Mean species / site:	0.22		
All depths (0-20')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	66.67	33.33	22.92	22.92	20.83	39.17
<i>Potamogeton praelongus</i>	White-stemmed pondweed	35.42	64.58	16.67	14.58	4.17	16.25
<i>Chara</i> species	Chara species	25.00	75.00	4.17	16.67	4.17	15.00
<i>Nitella</i> species	Nitella species	27.08	72.92	16.67	0.00	10.42	13.75
<i>Vallisneria americana</i>	Eel grass	27.08	72.92	22.92	4.17	0.00	7.08
<i>Potamogeton illinoensis</i>	Illinois pondweed	27.08	72.92	27.08	0.00	0.00	5.42
<i>Najas guadalupensis</i>	Southern naiad	20.83	79.17	18.75	2.08	0.00	5.00
<i>Stuckenia pectinatus</i>	Sago pondweed	18.75	81.25	16.67	2.08	0.00	4.58
<i>Potamogeton gramineus</i>	Grassy pondweed	16.67	83.33	14.58	2.08	0.00	4.17
<i>Utricularia vulgaris</i>	Common bladderwort	10.42	89.58	8.33	2.08	0.00	2.92
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	8.33	91.67	6.25	2.08	0.00	2.50
<i>Ceratophyllum demersum</i>	Coontail	4.17	95.83	4.17	0.00	0.00	0.83
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton berchtoldii</i>	Small pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Myriophyllum exalbesces</i>	Northern water milfoil	2.08	97.92	2.08	0.00	0.00	0.42
<i>Elodea canadensis</i>	Common water weed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton nodosus</i>	Long-leaf pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton friesii</i>	Flat-stalked pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Potamogeton foliosus</i>	Leafy pondweed	2.08	97.92	2.08	0.00	0.00	0.42
<i>Filamentous algae</i>	Filamentous algae	14.58					
0-5' stratum							
0-5' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	75.00	25.00	25.00	31.25	18.75	42.50
<i>Chara</i> species	Chara species	62.50	37.50	12.50	43.75	6.25	35.00
<i>Najas guadalupensis</i>	Southern naiad	37.50	62.50	31.25	6.25	0.00	10.00
<i>Stuckenia pectinatus</i>	Sago pondweed	37.50	62.50	31.25	6.25	0.00	10.00
<i>Vallisneria americana</i>	Eel grass	31.25	68.75	25.00	6.25	0.00	8.75
<i>Potamogeton illinoensis</i>	Illinois pondweed	37.50	62.50	37.50	0.00	0.00	7.50
<i>Potamogeton praelongus</i>	White-stemmed pondweed	25.00	75.00	25.00	0.00	0.00	5.00
<i>Utricularia vulgaris</i>	Common bladderwort	18.75	81.25	18.75	0.00	0.00	3.75
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	12.50	87.50	12.50	0.00	0.00	2.50
<i>Potamogeton gramineus</i>	Grassy pondweed	12.50	87.50	12.50	0.00	0.00	2.50
<i>Potamogeton berchtoldii</i>	Small pondweed	6.25	93.75	6.25	0.00	0.00	1.25
<i>Potamogeton nodosus</i>	Long-leaf pondweed	6.25	93.75	6.25	0.00	0.00	1.25
<i>Potamogeton friesii</i>	Flat-stalked pondweed	6.25	93.75	6.25	0.00	0.00	1.25
<i>Ceratophyllum demersum</i>	Coontail	6.25	93.75	6.25	0.00	0.00	1.25
<i>Filamentous algae</i>	Filamentous algae	37.50					

5-10' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	100.00	0.00	33.33	26.67	40.00	62.67
<i>Potamogeton praelongus</i>	White-stemmed pondweed	46.67	53.33	13.33	26.67	6.67	25.33
<i>Chara</i> species	Chara species	13.33	86.67	0.00	6.67	6.67	10.67
<i>Vallisneria americana</i>	Eel grass	40.00	60.00	33.33	6.67	0.00	10.67
<i>Potamogeton illinoensis</i>	Illinois pondweed	46.67	53.33	46.67	0.00	0.00	9.33
<i>Potamogeton gramineus</i>	Grassy pondweed	33.33	66.67	26.67	6.67	0.00	9.33
<i>Nitella</i> species	Nitella species	13.33	86.67	6.67	0.00	6.67	8.00
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	13.33	86.67	6.67	6.67	0.00	5.33
<i>Utricularia vulgaris</i>	Common bladderwort	13.33	86.67	6.67	6.67	0.00	5.33
<i>Stuckenia pectinatus</i>	Sago pondweed	20.00	80.00	20.00	0.00	0.00	4.00
<i>Najas guadalupensis</i>	Southern naiad	13.33	86.67	13.33	0.00	0.00	2.67
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	6.67	93.33	6.67	0.00	0.00	1.33
<i>Myriophyllum exalbescens</i>	Northern water milfoil	6.67	93.33	6.67	0.00	0.00	1.33
<i>Potamogeton foliosus</i>	Leafy pondweed	6.67	93.33	6.67	0.00	0.00	1.33
<i>Filamentous algae</i>	Filamentous algae	6.67					
10-15' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Nitella</i> species	Nitella species	55.56	44.44	22.22	0.00	33.33	37.78
<i>Potamogeton praelongus</i>	White-stemmed pondweed	55.56	44.44	11.11	33.33	11.11	33.33
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	44.44	55.56	11.11	22.22	11.11	26.67
<i>Vallisneria americana</i>	Eel grass	22.22	77.78	22.22	0.00	0.00	4.44
<i>Najas guadalupensis</i>	Southern naiad	11.11	88.89	11.11	0.00	0.00	2.22
<i>Potamogeton gramineus</i>	Grassy pondweed	11.11	88.89	11.11	0.00	0.00	2.22
15-20' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Nitella</i> species	Nitella species	75.00	25.00	62.50	0.00	12.50	25.00
<i>Najas guadalupensis</i>	Southern naiad	12.50	87.50	12.50	0.00	0.00	2.50
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	12.50	87.50	12.50	0.00	0.00	2.50
<i>Elodea canadensis</i>	Common water weed	12.50	87.50	12.50	0.00	0.00	2.50
<i>Potamogeton praelongus</i>	White-stemmed pondweed	12.50	87.50	12.50	0.00	0.00	2.50
<i>Ceratophyllum demersum</i>	Coontail	12.50	87.50	12.50	0.00	0.00	2.50

Occurrence and abundance of submersed aquatic plants in Little Barbee Lake.							
Total Sites:	40	Mean species / site:	1.25	Native diversity:	0.41		
Littoral Sites:	36	Maximum species / site:	4	Species diversity:	0.49		
Littoral Depth (ft):	14	Number of species:	8	SE Mean natives / site:	0.10		
Date:	8/8/07	Littoral sites with plants:	36	Mean natives / site:	1.15		
Lake:	Little Barbee	Secchi(ft):	6.5	SE Mean species / site:	0.12		
All depths (0-15')		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	87.50	12.50	12.50	7.50	67.50	74.50
<i>Elodea canadensis</i>	Common water weed	5.00	95.00	2.50	2.50	0.00	2.00
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	10.00	90.00	10.00	0.00	0.00	2.00
<i>Najas guadalupensis</i>	Southern naiad	7.50	92.50	7.50	0.00	0.00	1.50
<i>Utricularia vulgaris</i>	Common bladderwort	5.00	95.00	5.00	0.00	0.00	1.00
<i>Stuckenia pectinatus</i>	Sago pondweed	5.00	95.00	5.00	0.00	0.00	1.00
<i>Myriophyllum exallescens</i>	Northern water milfoil	2.50	97.50	2.50	0.00	0.00	0.50
<i>Chara</i> species	Chara species	2.50	97.50	2.50	0.00	0.00	0.50
Filamentous algae	Filamentous algae	65.00					
0-5' stratum							
0-5' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	88.89	11.11	0.00	5.56	83.33	86.67
<i>Elodea canadensis</i>	Common water weed	5.56	94.44	0.00	5.56	0.00	3.33
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	16.67	83.33	16.67	0.00	0.00	3.33
<i>Utricularia vulgaris</i>	Common bladderwort	11.11	88.89	11.11	0.00	0.00	2.22
<i>Stuckenia pectinatus</i>	Sago pondweed	11.11	88.89	11.11	0.00	0.00	2.22
<i>Najas guadalupensis</i>	Southern naiad	5.56	94.44	5.56	0.00	0.00	1.11
<i>Myriophyllum exallescens</i>	Northern water milfoil	5.56	94.44	5.56	0.00	0.00	1.11
<i>Chara</i> species	Chara species	5.56	94.44	5.56	0.00	0.00	1.11
Filamentous algae	Filamentous algae	72.22					
5-10' stratum							
5-10' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	92.31	7.69	23.08	15.38	53.85	67.69
<i>Najas guadalupensis</i>	Southern naiad	15.38	84.62	15.38	0.00	0.00	3.08
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	7.69	92.31	7.69	0.00	0.00	1.54
Filamentous algae	Filamentous algae	38.46					
10-15' stratum							
10-15' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	77.78	22.22	22.22	0.00	55.56	60.00
<i>Elodea canadensis</i>	Common water weed	11.11	88.89	11.11	0.00	0.00	2.22
Filamentous algae	Filamentous algae	88.89					

Occurrence and abundance of submersed aquatic plants in Sawmill Lake.							
Total Sites:	41	Mean species / site:	1.88	Native diversity:	0.60		
Littoral Sites:	41	Maximum species / site:	4	Species diversity:	0.69		
Littoral Depth (ft):	10	Number of species:	9	SE Mean natives / site:	0.13		
Date:	8/24/07	Littoral sites with plants:	41	Mean natives / site:	1.61		
Lake:	sawmill	Secchi(ft):	7.2	SE Mean species / site:	0.14		
All depths (0-10')		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	97.56	2.44	31.71	26.83	39.02	61.46
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	26.83	73.17	24.39	2.44	0.00	6.34
<i>Najas guadalupensis</i>	Southern naiad	19.51	80.49	14.63	4.88	0.00	5.85
<i>Stuckenia pectinatus</i>	Sago pondweed	14.63	85.37	14.63	0.00	0.00	2.93
<i>Utricularia vulgaris</i>	Common bladderwort	9.76	90.24	9.76	0.00	0.00	1.95
<i>Elodea canadensis</i>	Common water weed	7.32	92.68	7.32	0.00	0.00	1.46
<i>Najas flexilis</i>	Slender naiad	4.88	95.12	4.88	0.00	0.00	0.98
<i>Chara species</i>	Chara species	4.88	95.12	4.88	0.00	0.00	0.98
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	2.44	97.56	2.44	0.00	0.00	0.49
<i>Filamentous algae</i>	Filamentous algae	92.68					
0-5' stratum							
0-5' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	96.00	4.00	36.00	28.00	32.00	56.00
<i>Najas guadalupensis</i>	Southern naiad	20.00	80.00	12.00	8.00	0.00	7.20
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	24.00	76.00	20.00	4.00	0.00	6.40
<i>Stuckenia pectinatus</i>	Sago pondweed	24.00	76.00	24.00	0.00	0.00	4.80
<i>Utricularia vulgaris</i>	Common bladderwort	8.00	92.00	8.00	0.00	0.00	1.60
<i>Najas flexilis</i>	Slender naiad	8.00	92.00	8.00	0.00	0.00	1.60
<i>Chara species</i>	Chara species	8.00	92.00	8.00	0.00	0.00	1.60
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	4.00	96.00	4.00	0.00	0.00	0.80
<i>Elodea canadensis</i>	Common water weed	4.00	96.00	4.00	0.00	0.00	0.80
<i>Filamentous algae</i>	Filamentous algae	100.00					
5-10' stratum							
5-10' stratum		Frequency of	Frequency per Species				
Scientific Name	Common Name	Occurrence	0	1	3	5	Dominance
<i>Ceratophyllum demersum</i>	Coontail	100.00	0.00	25.00	25.00	50.00	70.00
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	31.25	68.75	31.25	0.00	0.00	6.25
<i>Najas guadalupensis</i>	Southern naiad	18.75	81.25	18.75	0.00	0.00	3.75
<i>Utricularia vulgaris</i>	Common bladderwort	12.50	87.50	12.50	0.00	0.00	2.50
<i>Elodea canadensis</i>	Common water weed	12.50	87.50	12.50	0.00	0.00	2.50
<i>Filamentous algae</i>	Filamentous algae	81.25					

Occurrence and abundance of submersed aquatic plants in Sechrist Lake.							
Total Sites:	49	Mean species / site:	2.71	Native diversity:	0.91		
Littoral Sites:	48	Maximum species / site:	8	Species diversity:	0.91		
Littoral Depth (ft):	20	Number of species:	16	SE Mean natives / site:	0.27		
Date:	8/24/07	Littoral sites with plants:	44	Mean natives / site:	2.69		
Lake:	Sechrist	Secchi(ft):	9.5	SE Mean species / site:	0.27		
All depths (0-20')		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Vallisneria americana</i>	Eel grass	36.73	63.27	16.33	10.20	10.20	19.59
<i>Stuckenia pectinatus</i>	Sago pondweed	36.73	63.27	24.49	4.08	8.16	15.51
<i>Chara</i> species	Chara species	28.57	71.43	14.29	10.20	4.08	13.06
<i>Ceratophyllum demersum</i>	Coontail	32.65	67.35	20.41	10.20	2.04	12.24
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	32.65	67.35	24.49	6.12	2.04	10.61
<i>Najas guadalupensis</i>	Southern naiad	16.33	83.67	12.24	2.04	2.04	5.71
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	20.41	79.59	18.37	2.04	0.00	4.90
<i>Heteranthera dubia</i>	Water star grass	14.29	85.71	14.29	0.00	0.00	2.86
<i>Potamogeton praelongus</i>	White-stemmed pondweed	12.24	87.76	12.24	0.00	0.00	2.45
<i>Nitella</i> species	Nitella species	12.24	87.76	12.24	0.00	0.00	2.45
<i>Potamogeton richardsonii</i>	Richardson's pondweed	2.04	97.96	0.00	0.00	2.04	2.04
<i>Potamogeton illinoensis</i>	Illinois pondweed	10.20	89.80	10.20	0.00	0.00	2.04
<i>Potamogeton gramineus</i>	Grassy pondweed	10.20	89.80	10.20	0.00	0.00	2.04
<i>Potamogeton berchtoldii</i>	Small pondweed	6.12	93.88	6.12	0.00	0.00	1.22
<i>Najas flexilis</i>	Slender naiad	2.04	97.96	2.04	0.00	0.00	0.41
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	2.04	97.96	2.04	0.00	0.00	0.41
Filamentous algae	Filamentous algae	12.24					
0-5' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Vallisneria americana</i>	Eel grass	68.75	31.25	25.00	25.00	18.75	38.75
<i>Chara</i> species	Chara species	62.50	37.50	18.75	31.25	12.50	35.00
<i>Stuckenia pectinatus</i>	Sago pondweed	75.00	25.00	50.00	6.25	18.75	32.50
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	43.75	56.25	25.00	12.50	6.25	18.75
<i>Potamogeton richardsonii</i>	Richardson's pondweed	6.25	93.75	0.00	0.00	6.25	6.25
<i>Potamogeton praelongus</i>	White-stemmed pondweed	25.00	75.00	25.00	0.00	0.00	5.00
<i>Potamogeton gramineus</i>	Grassy pondweed	25.00	75.00	25.00	0.00	0.00	5.00
<i>Najas guadalupensis</i>	Southern naiad	25.00	75.00	25.00	0.00	0.00	5.00
<i>Potamogeton illinoensis</i>	Illinois pondweed	18.75	81.25	18.75	0.00	0.00	3.75
<i>Ceratophyllum demersum</i>	Coontail	18.75	81.25	18.75	0.00	0.00	3.75
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	12.50	87.50	12.50	0.00	0.00	2.50
<i>Potamogeton berchtoldii</i>	Small pondweed	6.25	93.75	6.25	0.00	0.00	1.25
<i>Heteranthera dubia</i>	Water star grass	6.25	93.75	6.25	0.00	0.00	1.25
Filamentous algae	Filamentous algae	6.25					

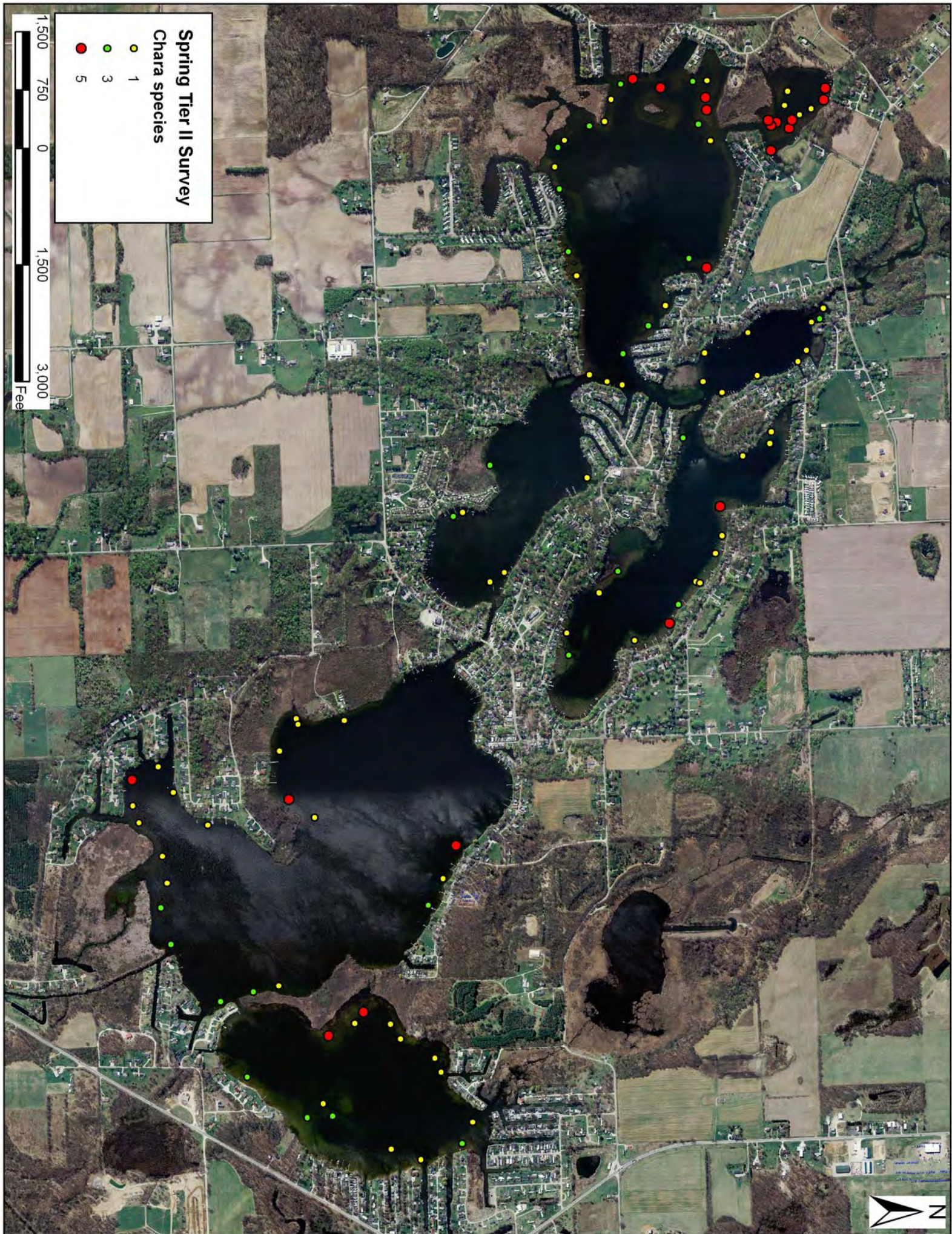
5-10' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Vallisneria americana</i>	Eel grass	45.45	54.55	18.18	9.09	18.18	27.27
<i>Stuckenia pectinatus</i>	Sago pondweed	36.36	63.64	18.18	9.09	9.09	18.18
<i>Najas guadalupensis</i>	Southern naiad	27.27	72.73	9.09	9.09	9.09	16.36
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	36.36	63.64	27.27	9.09	0.00	10.91
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	27.27	72.73	18.18	9.09	0.00	9.09
<i>Chara</i> species	Chara species	36.36	63.64	36.36	0.00	0.00	7.27
<i>Heteranthera dubia</i>	Water star grass	27.27	72.73	27.27	0.00	0.00	5.45
<i>Potamogeton praelongus</i>	White-stemmed pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Potamogeton illinoensis</i>	Illinois pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Potamogeton gramineus</i>	Grassy pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Potamogeton berchtoldii</i>	Small pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Najas flexilis</i>	Slender naiad	9.09	90.91	9.09	0.00	0.00	1.82
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	9.09	90.91	9.09	0.00	0.00	1.82
<i>Ceratophyllum demersum</i>	Coontail	9.09	90.91	9.09	0.00	0.00	1.82
Filamentous algae	Filamentous algae	18.18					
10-15' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	72.73	27.27	27.27	36.36	9.09	36.36
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	36.36	63.64	36.36	0.00	0.00	7.27
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	27.27	72.73	27.27	0.00	0.00	5.45
<i>Nitella</i> species	Nitella species	18.18	81.82	18.18	0.00	0.00	3.64
<i>Heteranthera dubia</i>	Water star grass	18.18	81.82	18.18	0.00	0.00	3.64
<i>Potamogeton praelongus</i>	White-stemmed pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Stuckenia pectinatus</i>	Sago pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Potamogeton berchtoldii</i>	Small pondweed	9.09	90.91	9.09	0.00	0.00	1.82
<i>Najas guadalupensis</i>	Southern naiad	9.09	90.91	9.09	0.00	0.00	1.82
Filamentous algae	Filamentous algae	18.18					
15-20' stratum		Frequency of Occurrence	Frequency per Species				Dominance
Scientific Name	Common Name		0	1	3	5	
<i>Ceratophyllum demersum</i>	Coontail	40.00	60.00	30.00	10.00	0.00	12.00
<i>Nitella</i> species	Nitella species	40.00	60.00	40.00	0.00	0.00	8.00
<i>Vallisneria americana</i>	Eel grass	10.00	90.00	10.00	0.00	0.00	2.00
<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	10.00	90.00	10.00	0.00	0.00	2.00
<i>Heteranthera dubia</i>	Water star grass	10.00	90.00	10.00	0.00	0.00	2.00
Filamentous algae	Filamentous algae	10.00					

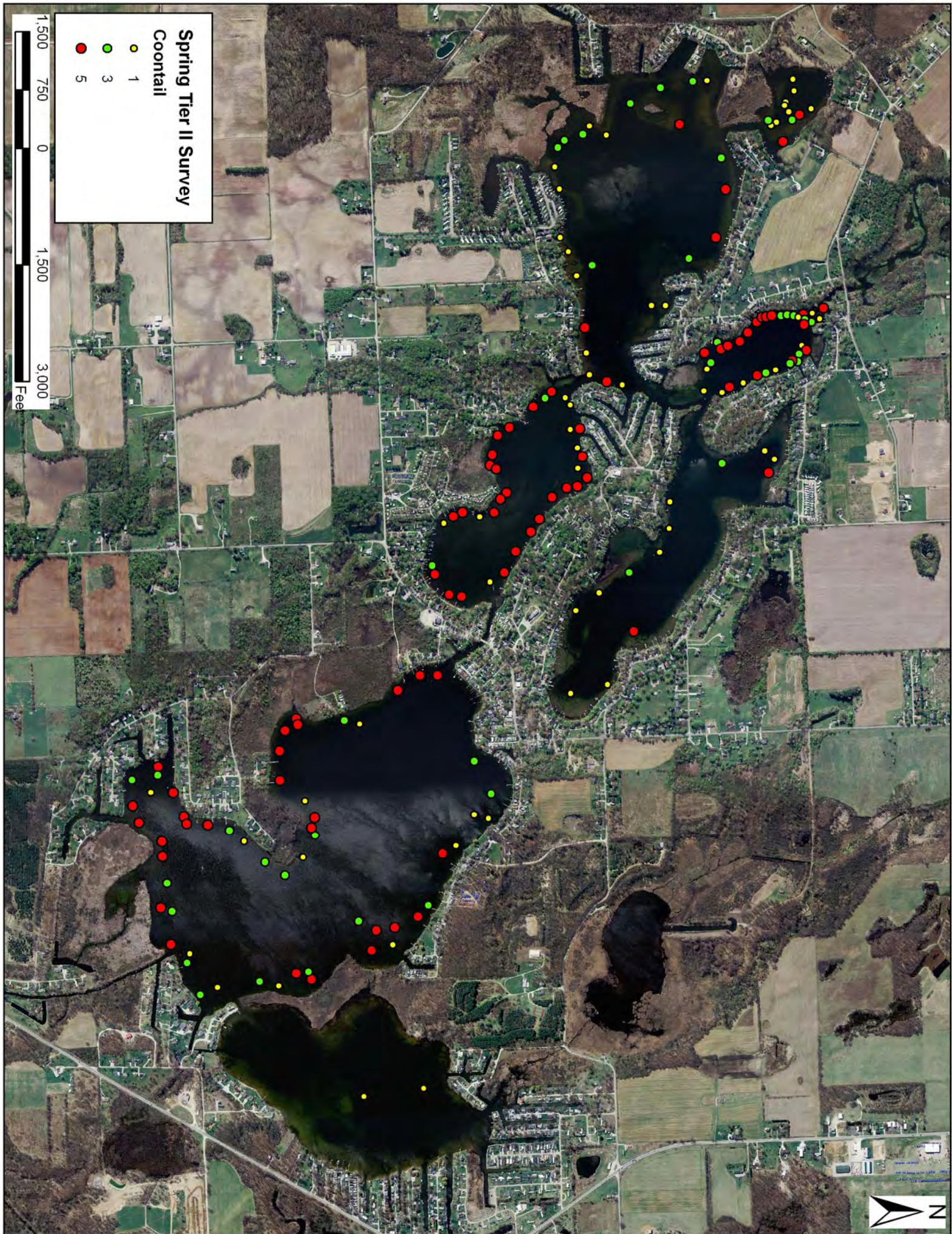
APPENDIX D:

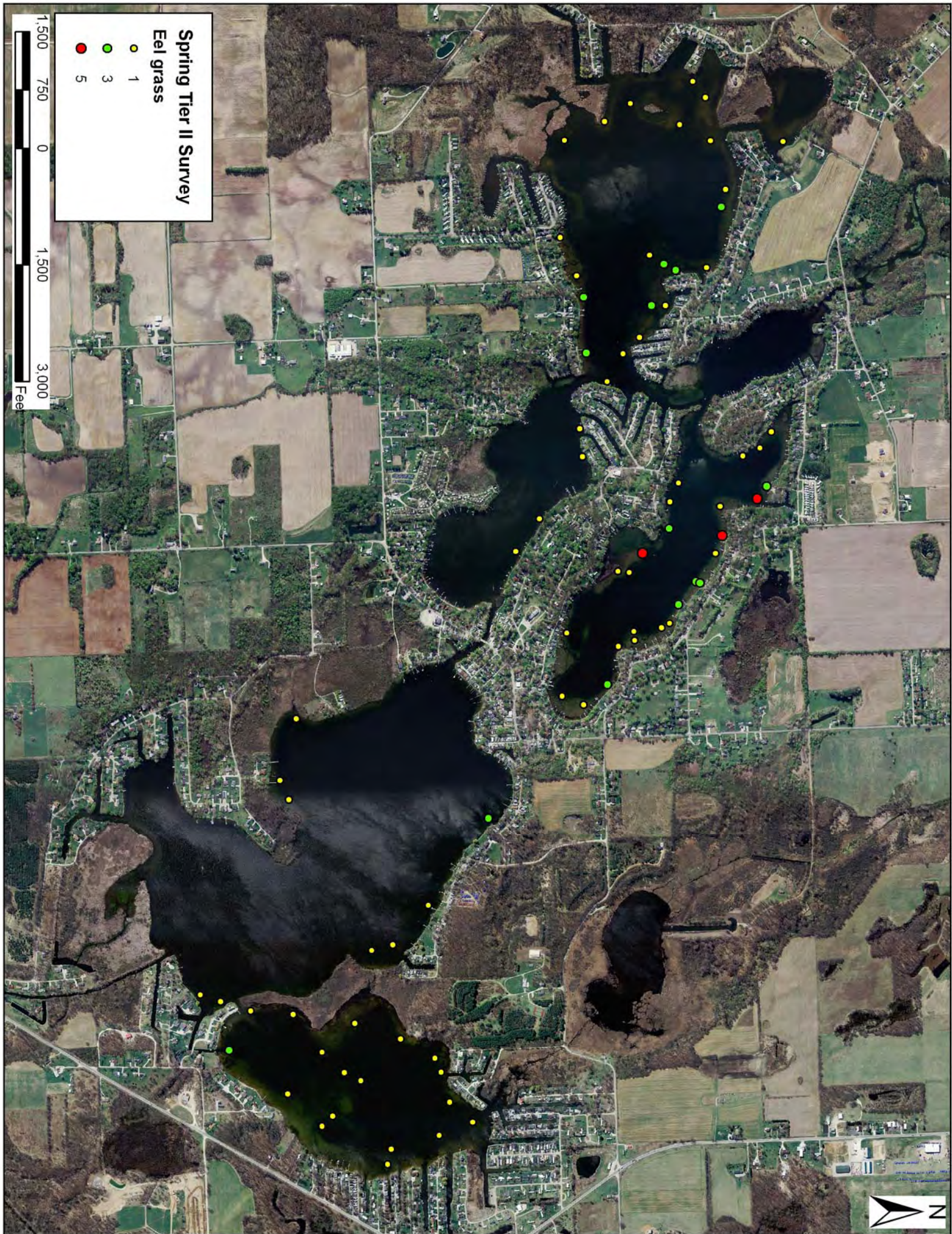
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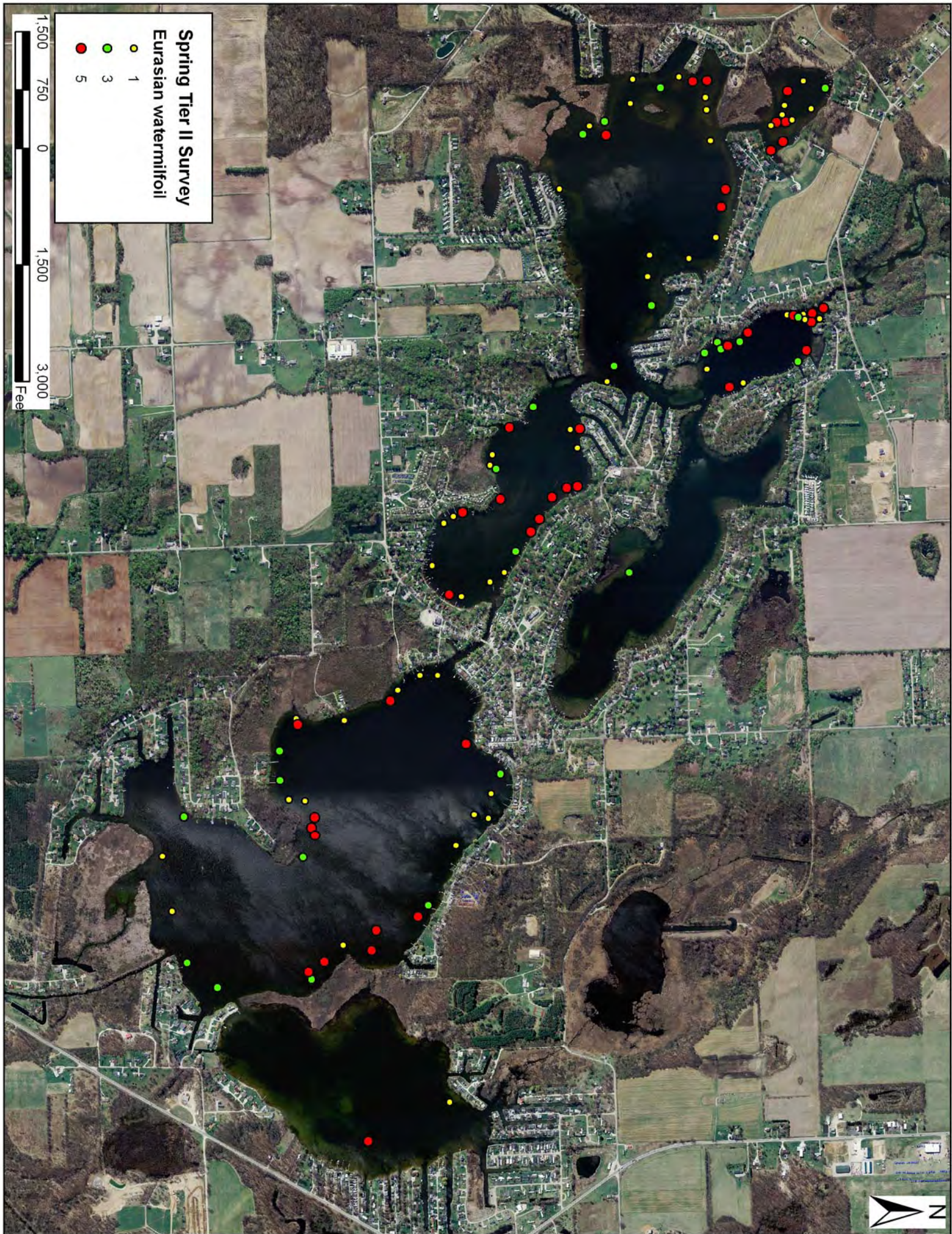
BARBEE LAKES

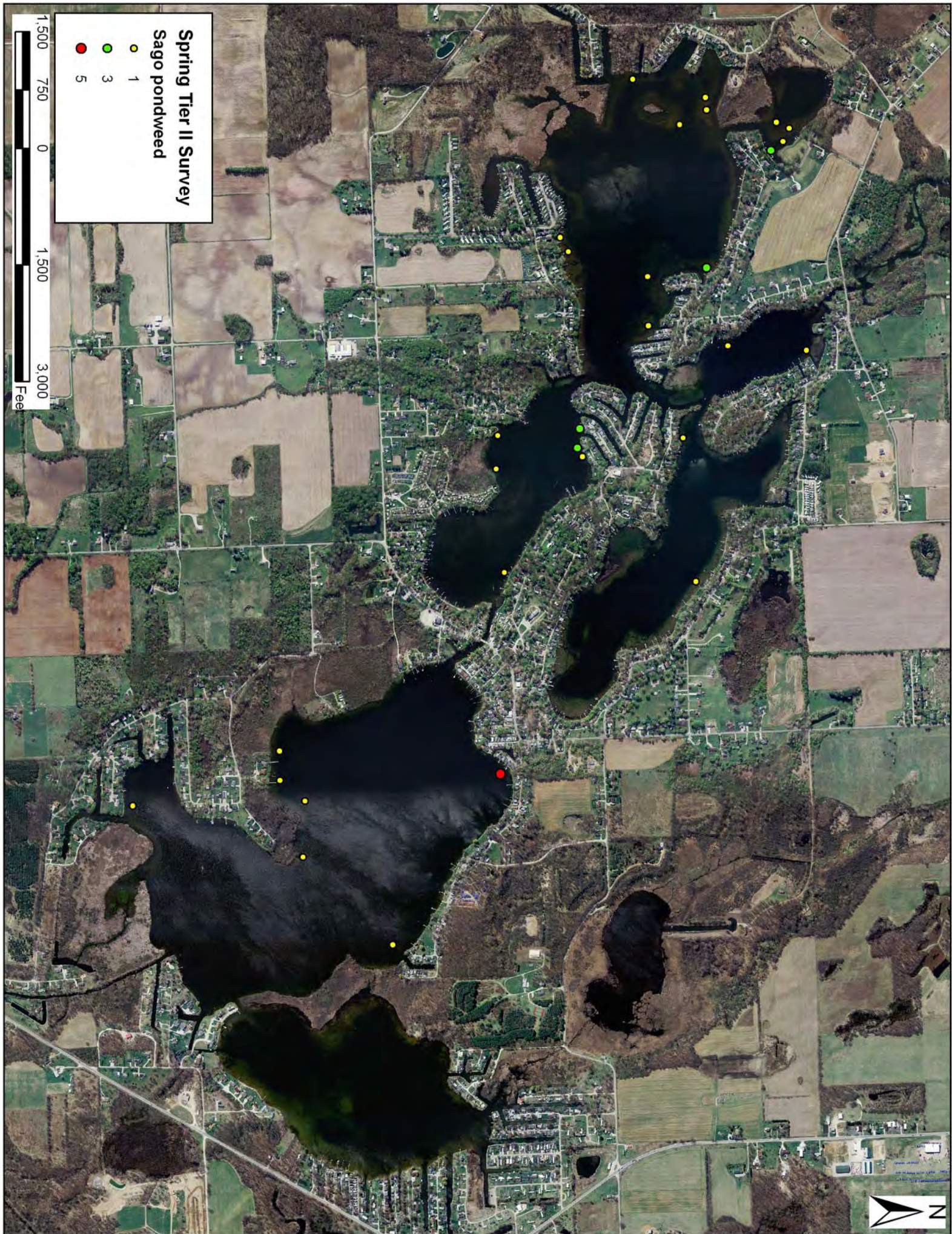
AQUATIC PLANT MANAGEMENT PLAN REVISION 2007-2011

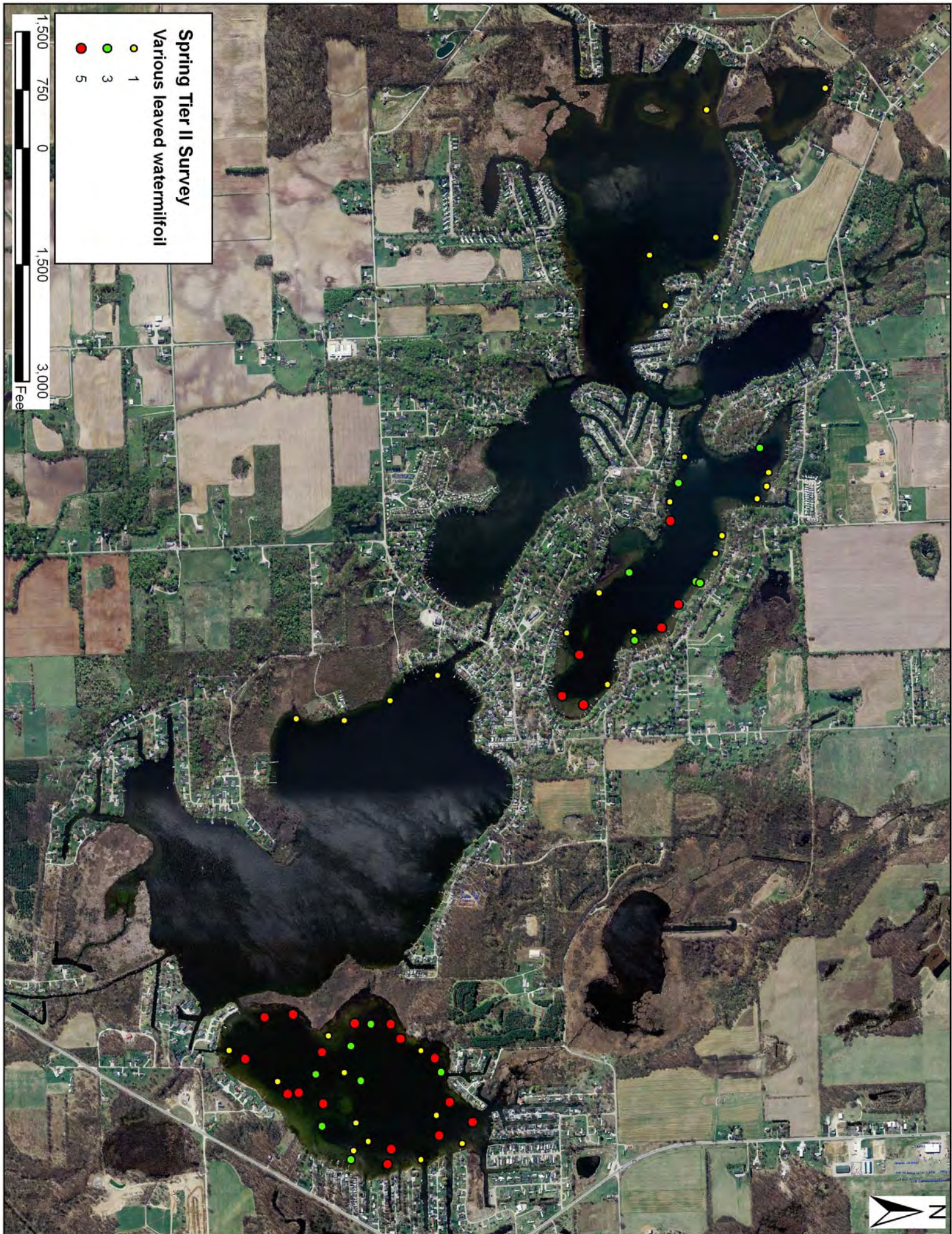


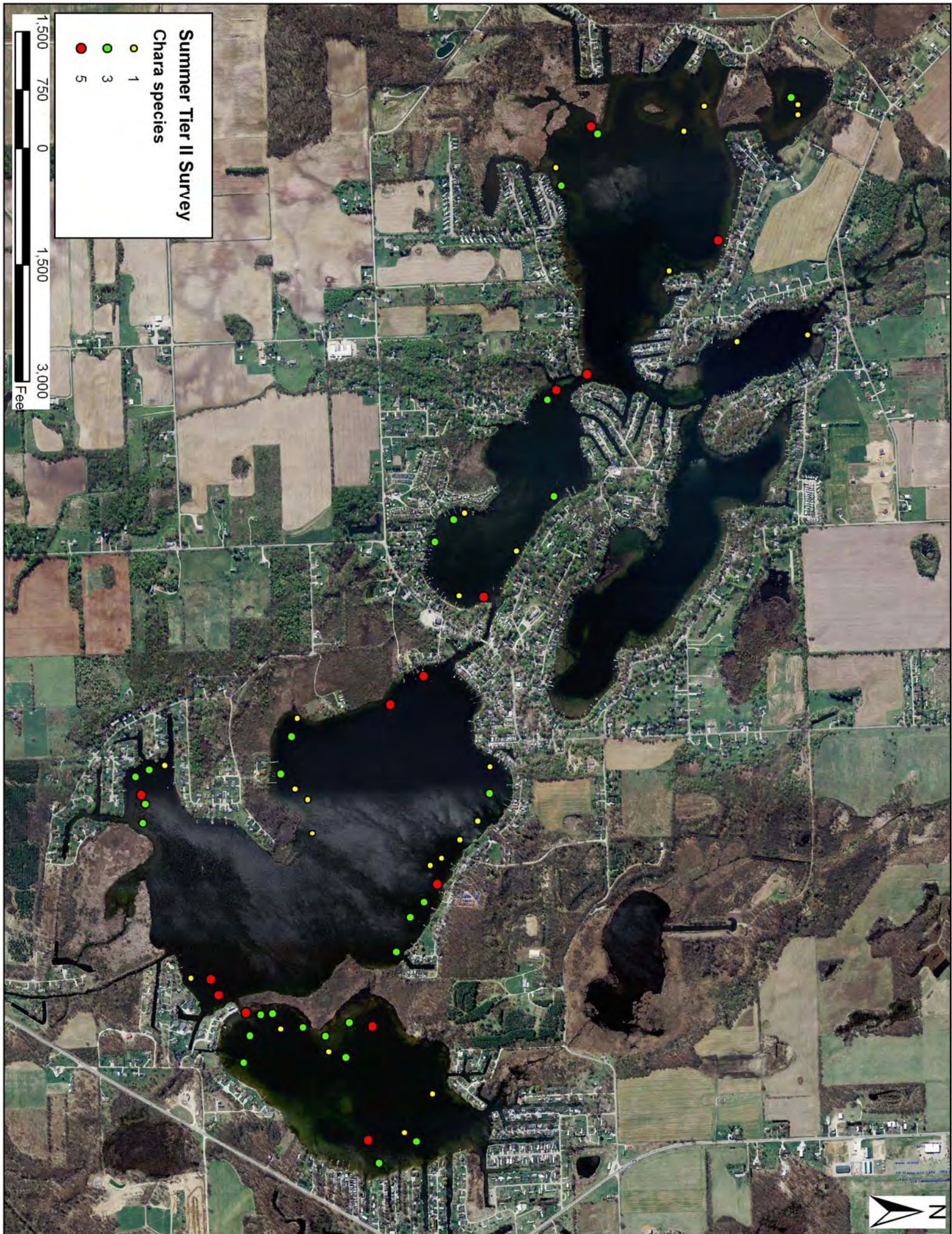


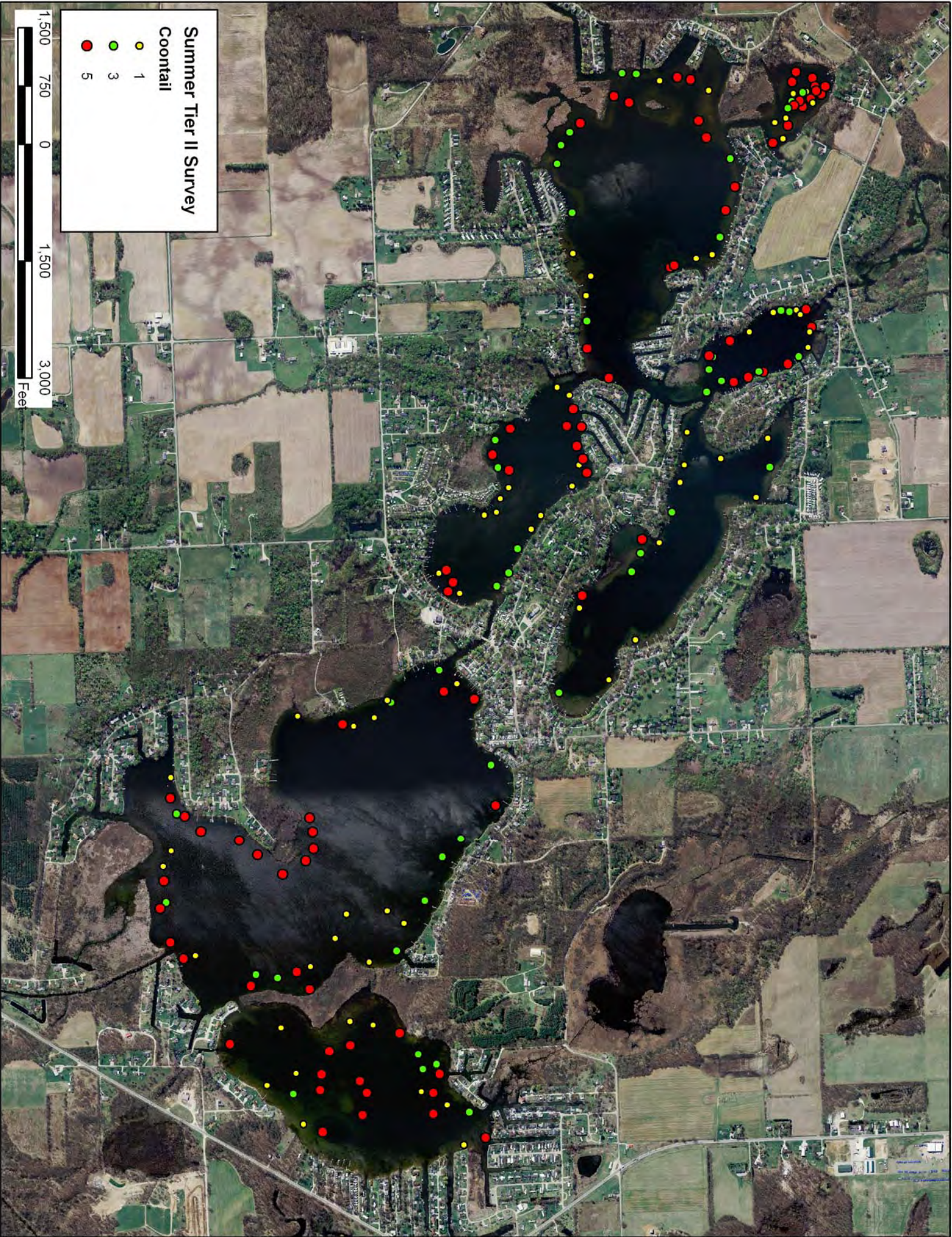


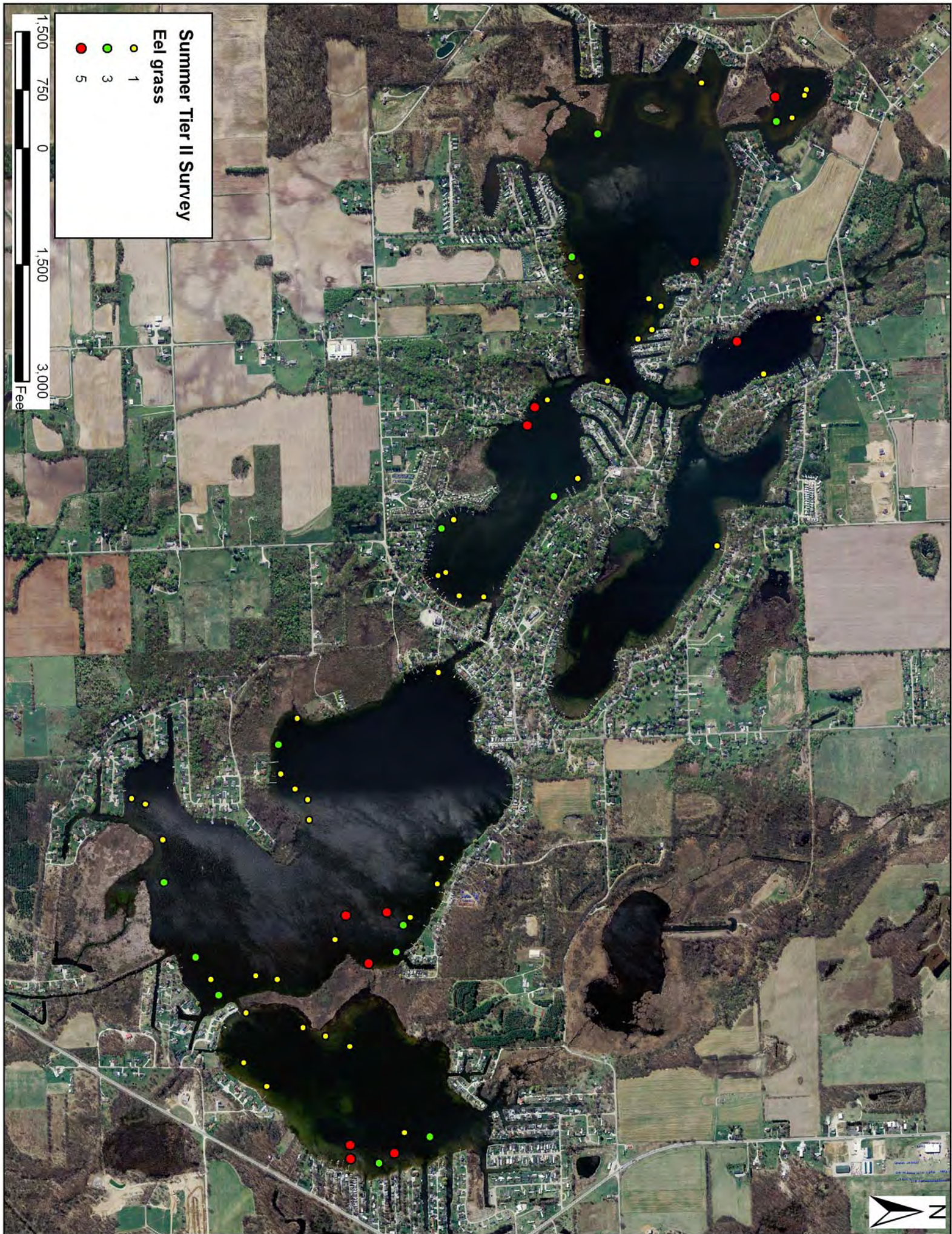


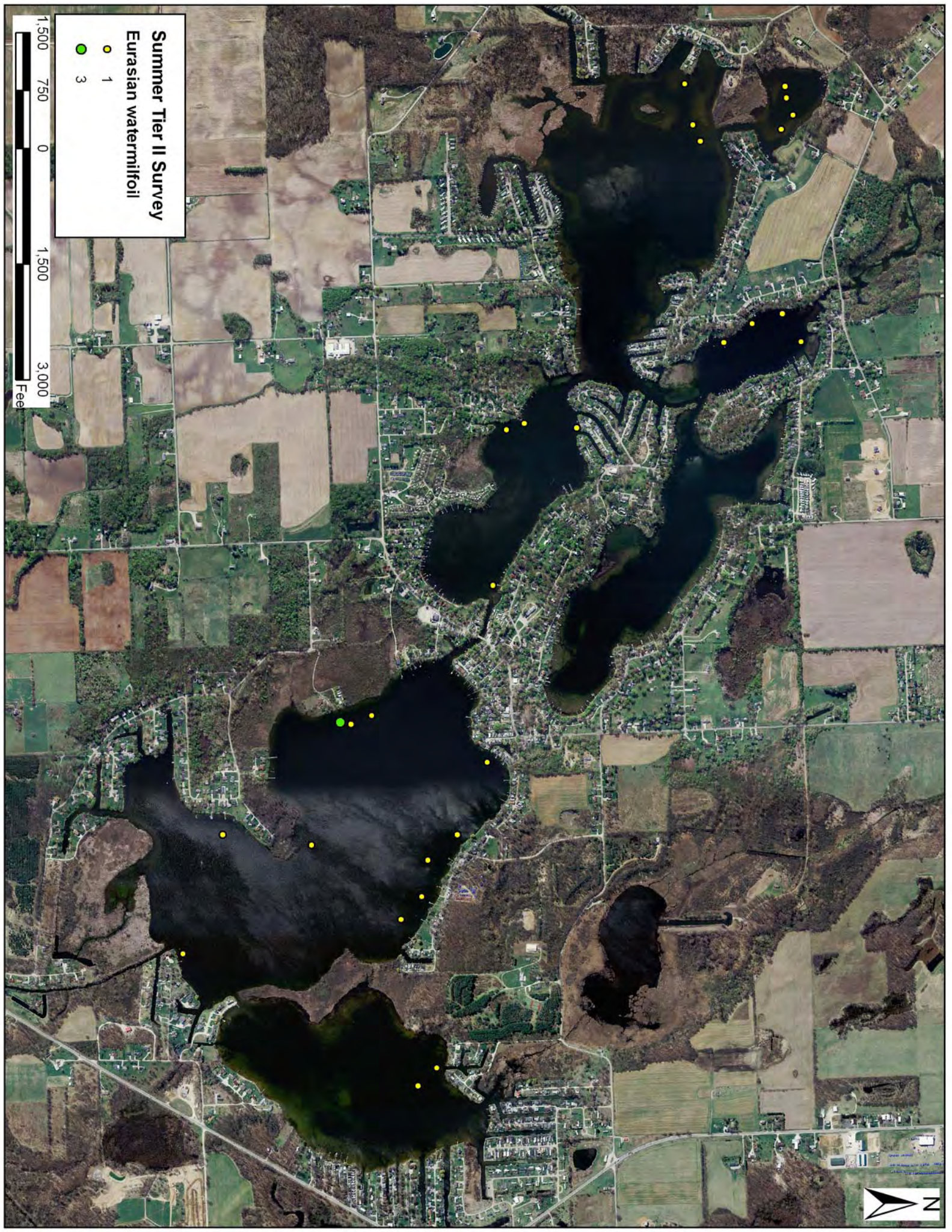










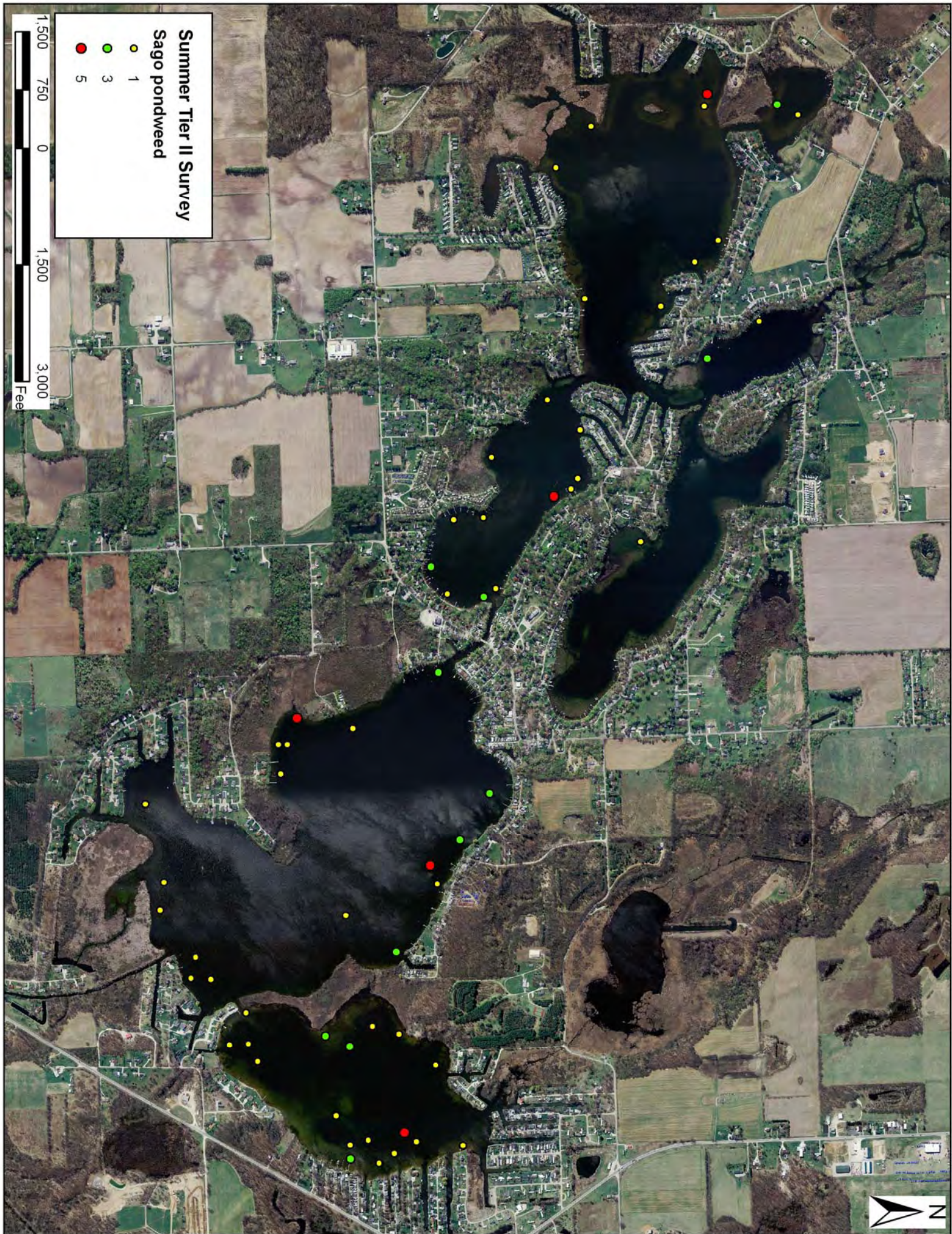


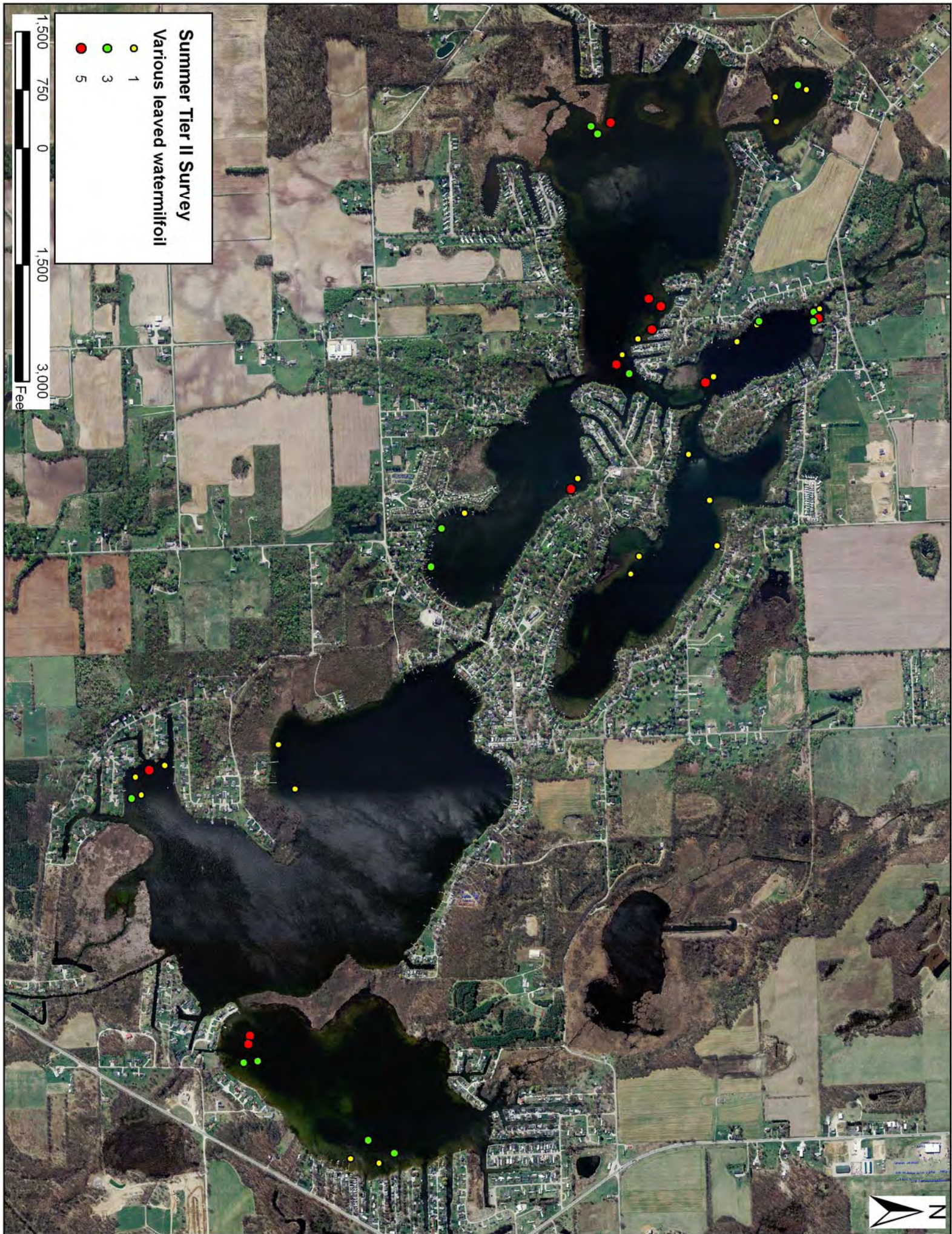
Summer Tier II Survey
Eurasian watermilfoil

- 1
- 3

1,500 750 0 1,500 3,000
Feet







APPENDIX E:
HYDRILLA INFORMATION
BARBEE LAKES
AQUATIC PLANT MANAGEMENT PLAN REVISION 2007-2011

AIS

Aquatic Invasive Species

HYDRILLA



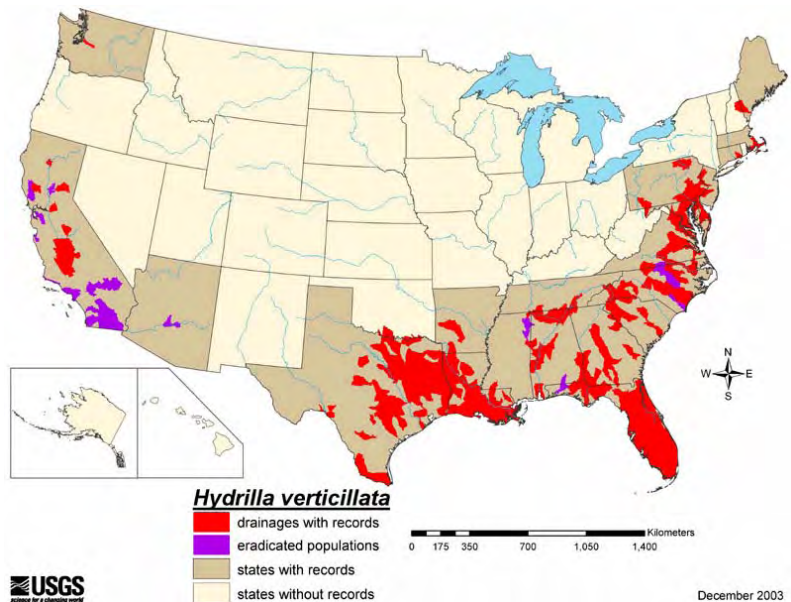
COMMON NAME: Hydrilla

Hydrilla is also known as water thyme, Florida elodea, Wasserquirle and Indian star-vine.

SCIENTIFIC NAME: *Hydrilla verticillata* (L.f.) Royle

Hydrilla's scientific name is made up of the Greek word "hydro" meaning "water" and the Latin word "verticillus" that means "the whorl of a spindle". Appropriately named, it is an aquatic plant with leaves that are whorled around the stem. Hydrilla is in the Frog's Bit family, or Hydrocharitaceae. It is the only species of the genus *Hydrilla* in the world though it resembles many of the other species in the family.

DISTRIBUTION: It is not really known where exactly hydrilla originated. Some sources give a broad native range of parts of Asia, Africa and Australia. Other sources are more specific and say that the dioecious form of hydrilla originated from the Indian subcontinent and the monoecious form originated from Korea. Currently the only continent without records of hydrilla is Antarctica.







Indiana: Hydrilla has not been detected in Indiana waters but it is on our Aquatic Nuisance Species watch list.

DESCRIPTION:

Leaves: Leaves are small about 2-4 mm wide and 6-20 mm long. They are strap-like with pointed tips and have visible saw-tooth margins. The leaves are whorled around the nodes in groups of 4-8 leaves. The leaf midvein is reddish in color and usually has a row of spines on it. This gives the plant a rough texture. The leaves are usually a green color, though topped out leaves could be bleached by the sun and appear more yellowish. Hydrilla has an axillary leaf scale called a squamula intravaginalis that is found next to the stem at the base of the leaf. This distinguishes it from the other species in the Hydrocharitaceae family. One may confuse hydrilla with another exotic weed, Brazilian elodea (*Egeria densa*). Hydrilla will have rough teeth on the underside of the leaves where Brazilian elodea will not. There is also a native species found in Indiana, American elodea (*Elodea canadensis*), which looks somewhat like hydrilla.

Identification Characteristics of the Hydrocharitaceae

Character	Brazilian Elodea (<i>Egeria densa</i>)	American Elodea (<i>Elodea canadensis</i>)	Hydrilla (monoecious) (<i>Hydrilla verticillata</i>)	Hydrilla (dioecious) (<i>Hydrilla verticillata</i>)
Leaves per Whorl	4 (3-5) 	3(2) 	5(2-8) 	4-5 (2-8) 
Serrated Edges Visible	With magnification	With magnification	Distinct on older plants	Distinct
Leaf Size	Up to 4cm	Up to 1.5 cm	1-2 cm	1-2 cm
Flowers	Male only, up to 2 cm	Tiny, male and female on separate plants	Male and female on same plants, to 1 cm	Only female plants in US, to 1 cm
Tubers Present	No	No	Yes	Yes

Roots/Stem: New root sprouts are white and when growing in highly organic soil they may become brown. They are submerged and buried in the hydro-soil. Hydrilla stems are very slender only about 1/32 of an inch wide, but they can grow to lengths of 30 feet. When the stem nears the waters surface it branches out considerably. The monoecious form of hydrilla will usually start to branch out at the sediment level rather than at the top of the water.

Flowers: The flowers are imperfect (meaning there are separate male and female flowers) but the plant can be monoecious (flowers of both sexes on one plant) or dioecious (flowers of one

sex being produced per plant). The female flower is white with three petals that alternate with three whitish sepals. The male flower has petals and sepals similar to the female flower, but the color could be white, reddish, or brown.

Fruits/Seeds: Hydrilla produce two different hibernacula to cover its buds. One is called a tuber, which forms terminally on rhizomes. They can be 5-10 mm long and are off white to yellow colored. Hydrilla also produces a turions which are compact dormant buds in the leaf axil. They are 5-8 mm long, dark green in color, and they appear to be spiny. The turion will break off and settle to the bottom of the water to start a new plant. The tubers are able to over winter and re-sprout as new plants as well. Seeds are also produced.

LIFE CYCLE BIOLOGY: Hydrilla is a submersed, herbaceous, perennial aquatic plant. It is capable of living in many different freshwater habitats. It will grow in springs, lakes, marshes, ditches, rivers, or anywhere there is a few inches of water. Hydrilla can tolerate low nutrient and high nutrient conditions as well as a salinity of up to 7%. Another adaptation hydrilla possesses, that enable it to out compete native plants, is the ability to grow in low light conditions. It is able to grow at deeper depths and can begin to photosynthesize earlier in the morning than most other aquatic plants. In the beginning stages of life hydrilla elongates at a rate of one inch per day. This continues until the plant comes close to the top of the water, here it begins to branch out. It produces a large mat of vegetation at the waters surface intercepting the light before it can reach other plants.

Hydrilla can reproduce in four different ways, fragmentation, tubers, turions, and seed. Fragmented pieces of hydrilla that contain at least one node are capable of sprouting into a new plant. The tubers of hydrilla are formed on the rhizomes and each one can produce 6,000 new tubers. When out of water a tuber can remain viable for several days, it can even lie dormant for over 4 years in undisturbed soil before sprouting a new plant. Turions are formed in the leaf axils of the plant. They are broken off and once settled in the sediment they can sprout into a new plant. Uncharacteristic of most plants, seed production in hydrilla is of least importance for reproduction. It seems that seed production is mostly used for long distance dispersal by means of ingestion by birds. The monoecious form of hydrilla puts more energy into tuber and turion production than does the dioecious form. It is good to know which form you have to decide on the best management technique.

The main adaptations that give hydrilla an advantage over other native plants are: it can grow at low light intensities, it is better at absorbing carbon dioxide from the water, it is able to store nutrients for later use, it can tolerate a wide range of water quality conditions, and it can propagate in four different ways.

PATHWAYS/HISTORY: Under the name Indian star-vine, hydrilla was imported into Florida as an aquarium plant in the 1950's. A farmer living near Tampa acquired the plant but was not impressed with it and threw it out into a canal behind his business. A few months later the farmer noticed that the hydrilla grew very well and decided to market it. By the 1960's severe problems caused by hydrilla were being reported. In 1990 hydrilla could be found in 187 lakes and rivers in Florida. Because there are two different strains of hydrilla found in the United States, the monoecious strain and the dioecious strain, it is believed that there was a separate introduction outside of Florida. The dioecious form is mainly found in the southern states and California and the monoecious form is found north of South Carolina. Hydrilla was brought to

national attention in 1980 when it was discovered in the Potomac River in Washington D.C. Currently hydrilla is found in approximately 690 bodies of water within 190 drainage basins of 21 states.

DISPERSAL/SPREAD: Once established hydrilla can easily spread to new areas. Fragmented pieces of the plant are able to root and develop into a new plant. These plant fragments are transported to new waters via boats and fishing equipment. Hydrilla's tubers and turions allow it to persist in an area. They can live dormant in the ground and can even resist a drought. Waterfowl are a vector of transport for hydrilla as well. Some waterfowl feed on the plant and may regurgitate the tubers into other bodies of water. It has been found that these tubers are still able to sprout. Birds can also spread seeds. Hydrilla is still sold for aquarium use over the Internet, which could mean expansion of its range through more introductions, accidental or otherwise.

RISKS/IMPACTS: Hydrilla is sometimes called an invisible menace because most of the time you don't know it is there until it has filled the water. It will shade out native aquatic plants until they are eliminated. This forms a monoculture, which will reduce biodiversity and alter the ecosystem. Hydrilla does not only pose a threat to other plants but to animals as well. When hydrilla becomes over abundant, fish population imbalances are likely. The dense mats of hydrilla will alter the waters chemistry by raising pH, cause wide oxygen fluctuations, and increase water temperature.

Hydrilla is an economic drain. Millions of dollars are lost due to reduced recreational opportunities as hydrilla mats interfere with boating, swimming, fishing, etc. In flowing waters hydrilla will greatly reduce flow and can cause flooding. For operations that require water intake, hydrilla can pose a problem by clogging the intake pipes. Waterfront property values drop in areas infested with hydrilla. Millions of dollars are annually spent trying to control this aquatic pest.

MANAGEMENT/PREVENTION: Control of aquatic weeds is difficult and eradication sometimes can be an unrealistic goal. Before any type of management technique can be implemented there needs to be a positive identification of the plant. Some native plants look similar to hydrilla so it is important to have proper identification.

Hydrilla has not yet appeared in Indiana, however it is not far away. If this plant shows up in Indiana waters, it needs to be eliminated immediately. While there are many methods available to control aquatic plants, the method most suitable for complete and fast elimination is chemical control. Aquatic herbicides containing the active ingredient endothall, fluridone, or diquat are all labeled for use on hydrilla.

For states that have major infestations of this pest plant, they have looked to hydrilla's native range for any insects that could be used as a biological control. Four hydrilla-attacking insects have been released. *Bagous affinis*, a hydrilla tuber-attacking weevil and *Hydrellia pakistanae*, a leaf-mining fly both were released in 1987. *Hydrellia balciunasi* is another leaf mining fly that was released in 1989. *Bagous hydrillae*, a stem-mining weevil, was released in 1991. Many different states have released one or a combination of the four insects. It is still too early to know what long-term impacts these insects will have on hydrilla. One Indiana company is helping to develop a biological control method for hydrilla. SePro Inc. of Carmel, Indiana is a

cooperator in a project with U.S. Army Engineer Research and Development Center Environmental Laboratory to grow an endemic fungal pathogen that attacks hydrilla.

Hydrilla has been listed by the U.S. government as a Federal Noxious Weed. With this designation, it is illegal to import or sell the plant in the United States. However, it is likely that internet sales still occur.

Like all invasive species, the key to preventing their spread is knowledge! You can also help by practicing a few good techniques to stop the spread of hydrilla and other aquatic invasive plants.

- ✓ Rinse any mud and/or debris from equipment and wading gear and drain any water from boats before leaving a launch area.
- ✓ Remove all plant fragments from the boat, propeller, and boat trailer. The transportation of plant material on boats, trailers, and in livewells is the main introduction route to new lakes and rivers.
- ✓ Do not release aquarium or water garden plants into the wild, rather seal them in a plastic bag and dispose in the trash.
- ✓ Consider using plants native to Indiana in aquariums and water gardens.
- ✓ If you detect this plant in a lake, pond, or stream, immediately contact the Indiana Department of Natural Resources, Division of Fish and Wildlife.
 - (317)232-4080
 - dkeller@dnr.IN.gov
 - 402 W. Washington St., Rm W273
Indianapolis, IN 46204

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PHOTOGRAPHS compliments of the Washington Department of Ecology

Updated 3/05

APPENDIX F:

2008 AQUATIC PLANT TREATMENT PERMIT APPLICATIONS

**BARBEE LAKES
AQUATIC PLANT MANAGEMENT PLAN REVISION 2007-2011**

Treatment Area #	2	LAT/LONG or UTM's
Total acres to be controlled	4	Proposed shoreline treatment length (ft) 2200 Perpendicular distance from shoreline (ft) 80
Maximum Depth of Treatment (ft)	6	Expected date(s) of treatment(s) April - May
Treatment method: <input checked="" type="checkbox"/> Chemical <input type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical		
Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Aquathol K		
Plant survey method: <input checked="" type="checkbox"/> Rake <input checked="" type="checkbox"/> Visual <input type="checkbox"/> Other (specify) Formal plant survey		
Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Curlyleaf Pondweed	X	10%
INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.		
Applicant Signature		Date
Certified Applicant's Signature		Date

FOR OFFICE ONLY	
<input type="checkbox"/> Approved <input type="checkbox"/> Disapproved	Fisheries Staff Specialist
<input type="checkbox"/> Approved <input type="checkbox"/> Disapproved	Environmental Staff Specialist
Mail check or money order in the amount of \$5.00 to: <div style="text-align: center;"> DEPARTMENT OF NATURAL RESOURCES DIVISION OF FISH AND WILDLIFE COMMERCIAL LICENSE CLERK 402 WEST WASHINGTON STREET ROOM W273 INDIANAPOLIS, IN 46204 </div>	

[illegible]

Treatment Area #	2	LAT/LONG or UTM's		
Total acres to be controlled	55	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft)	10	Expected date(s) of treatment(s)	April - May	
Treatment method:	<input checked="" type="checkbox"/> Chemical	<input type="checkbox"/> Physical	<input type="checkbox"/> Biological Control	<input type="checkbox"/> Mechanical
Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.				
Aquathol K				
Plant survey method:	<input checked="" type="checkbox"/> Rake	<input checked="" type="checkbox"/> Visual	<input type="checkbox"/> Other (specify)	Formal plant survey
Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community		
Curlyleaf Pondweed	X	29%		
INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.				
Applicant Signature		Date		
Certified Applicant's Signature		Date		

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 COMMERCIAL LICENSE CLERK
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 INDIANAPOLIS, IN 46204

[illegible]

Treatment Area #	2	LAT/LONG or UTM's	
Total acres to be controlled	10.4	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	8	Expected date(s) of treatment(s)	April - May
Treatment method: <input checked="" type="checkbox"/> Chemical <input type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical			
Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Aquathol K			
Plant survey method: <input checked="" type="checkbox"/> Rake <input checked="" type="checkbox"/> Visual <input type="checkbox"/> Other (specify) Formal plant survey			
Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community	
Curlyleaf Pondweed	X	42%	
<i>INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.</i>			
Applicant Signature			Date
Certified Applicant's Signature			Date

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APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R / 11-03)

Approved State Board of Accounts 1987

☐ Whole Lake

☒ Multiple Treatment Areas

Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY

License No.

Date Issued

Lake County

Return to: Page 1 of 3

DEPARTMENT OF NATURAL RESOURCES

Division of Fish and Wildlife

Commercial License Clerk

402 West Washington Street, Room W273

Indianapolis, IN 46204

FEE:	\$5.00
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Applicant's Name		Lake Assoc. Name	
		Barbee Lakes Property Owners Association	
Rural Route or Street		Phone Number	
P.O. Box 175			
City and State		ZIP Code	
North Webster, IN		46555	
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number	
Rural Route or Street		Phone Number	
City and State		ZIP Code	

Lake (One application per lake)	Nearest Town	County
Little Barbee	North Webster	Kosciusko
Does water flow into a water supply	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area # 1		LAT/LONG or UTM's			
Total acres to be controlled 20		Proposed shoreline treatment length (ft)		Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft) 6		Expected date(s) of treatment(s) May - August			
Treatment method:	<input checked="" type="checkbox"/> Chemical	<input type="checkbox"/> Physical	<input type="checkbox"/> Biological Control	<input type="checkbox"/> Mechanical	

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Copper Sulfate, Cygnat Plus

Plant survey method: ☒ Rake ☒ Visual ☐ Other (specify) _____ Formal plant survey

[illegible]

Treatment Area #	2	LAT/LONG or UTM's		
Total acres to be controlled	20.3	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft)	6	Expected date(s) of treatment(s)	April - May	
Treatment method:	<input checked="" type="checkbox"/> Chemical	<input type="checkbox"/> Physical	<input type="checkbox"/> Biological Control	<input type="checkbox"/> Mechanical
Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.				
Aquathol K				
Plant survey method:	<input checked="" type="checkbox"/> Rake	<input checked="" type="checkbox"/> Visual	<input type="checkbox"/> Other (specify)	Formal plant survey
Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community		
Curlyleaf Pondweed	X	7%		
INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.				
Applicant Signature		Date		
Certified Applicant's Signature		Date		

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[illegible]

Treatment Area #	2	LAT/LONG or UTM's
Total acres to be controlled	6	Proposed shoreline treatment length (ft) 2,000 Perpendicular distance from shoreline (ft) 100-200
Maximum Depth of Treatment (ft)	10	Expected date(s) of treatment(s) April - May
Treatment method: <input checked="" type="checkbox"/> Chemical <input type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical		
Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Aquathol K		
Plant survey method: <input checked="" type="checkbox"/> Rake <input checked="" type="checkbox"/> Visual <input type="checkbox"/> Other (specify) Formal plant survey		
Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Curlyleaf Pondweed	X	32%
INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.		
Applicant Signature		Date
Certified Applicant's Signature		Date

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